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Eto

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(45) **Date of Patent: Jan. 14, 2014**

(54) **IMAGE FORMING APPARATUS**

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(73) Assignee: **Kyocera Document Solutions Inc.**, Osaka (JP)

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May 31, 2010 (JP) 2010-125352

(51) **Int. Cl.**
G03G 15/00 (2006.01)

(52) **U.S. Cl.**
USPC **399/12**

(58) **Field of Classification Search**
USPC 399/9, 12, 13, 110, 111, 119, 120, 258, 399/260, 262
See application file for complete search history.

(56) **References Cited**

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(57) **ABSTRACT**

The present invention provides a detection unit that detects, regarding a toner supply device loaded into an installation space of an apparatus main body, a type of the toner supply device or detects improper loading of the toner supply device and a notification unit that notifies loading of the toner supply device of a wrong type or improper loading of the toner supply device based on a result of detection by the detection unit.

5 Claims, 16 Drawing Sheets

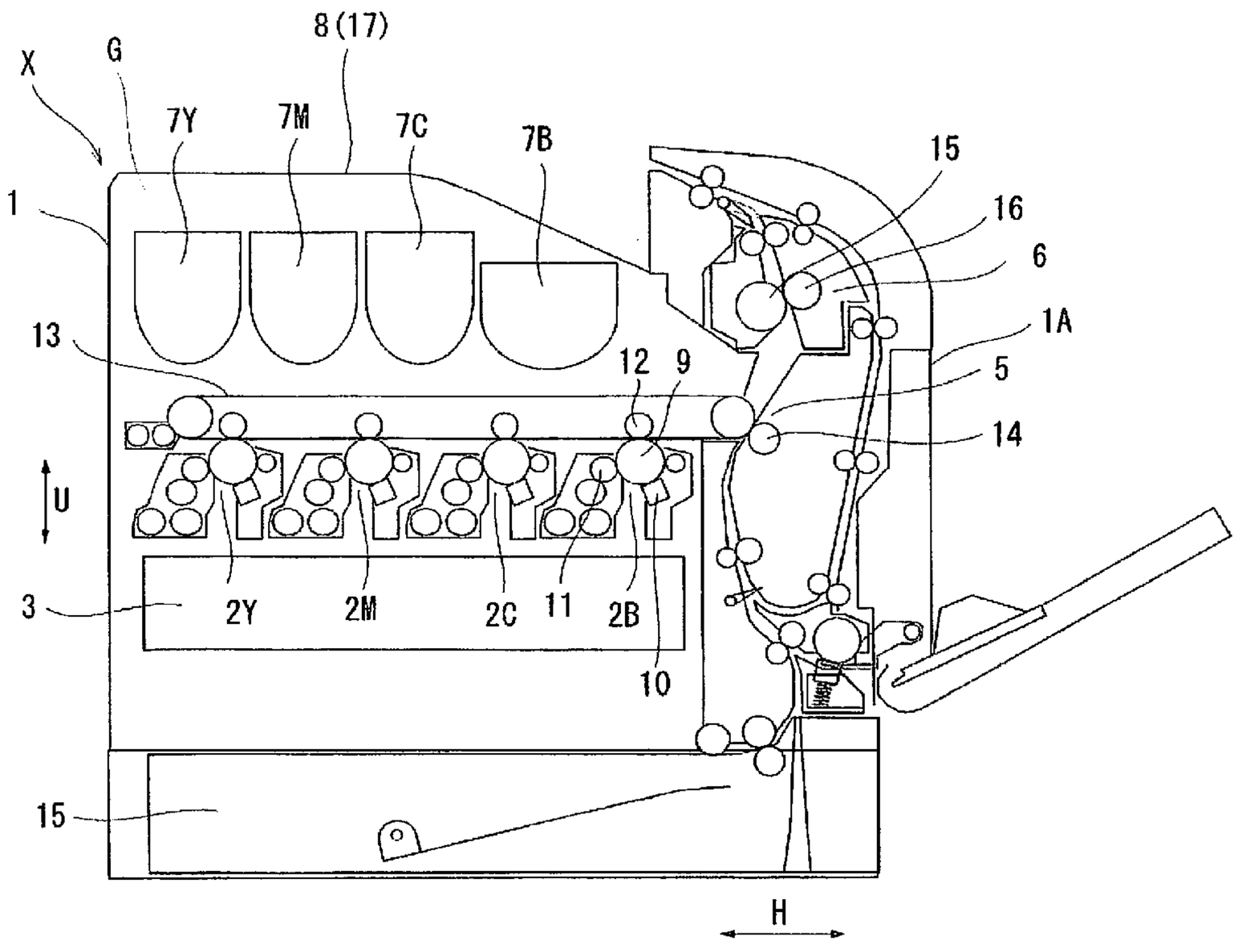


FIG. 1

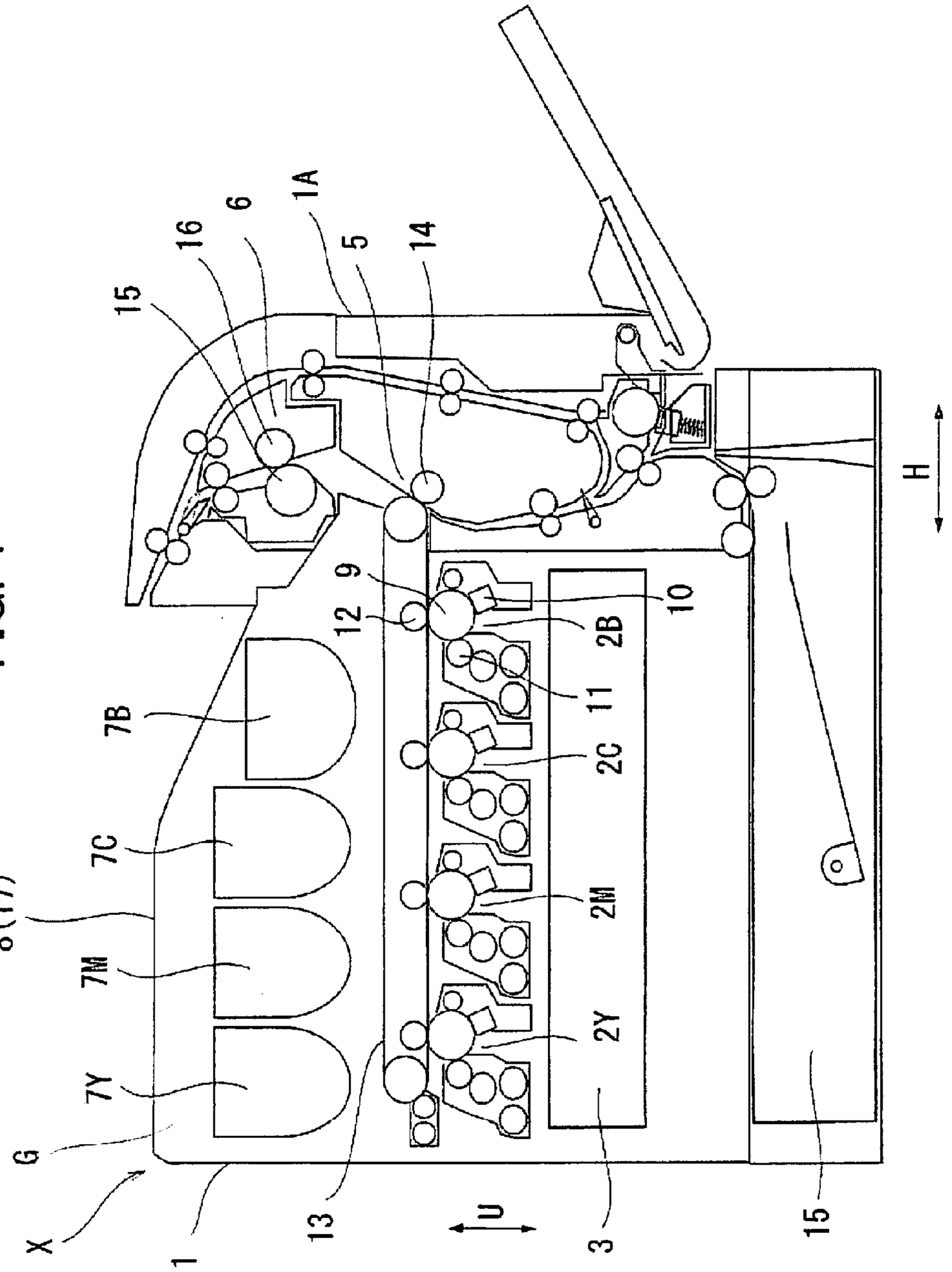


FIG. 2

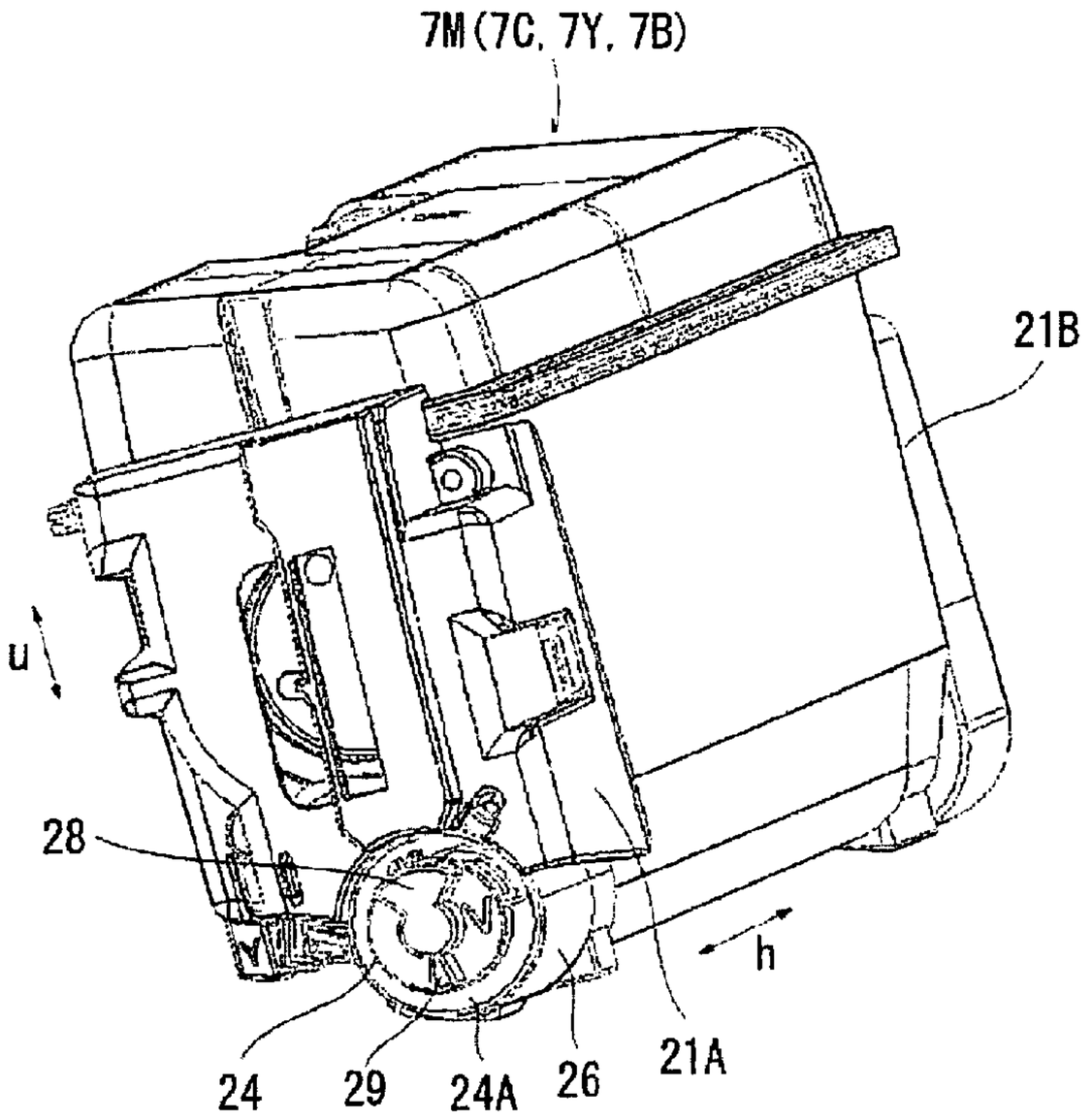

7M(7C, 7Y, 7B)
21B
u
28
h
24
29
24A
26
21A

FIG. 3

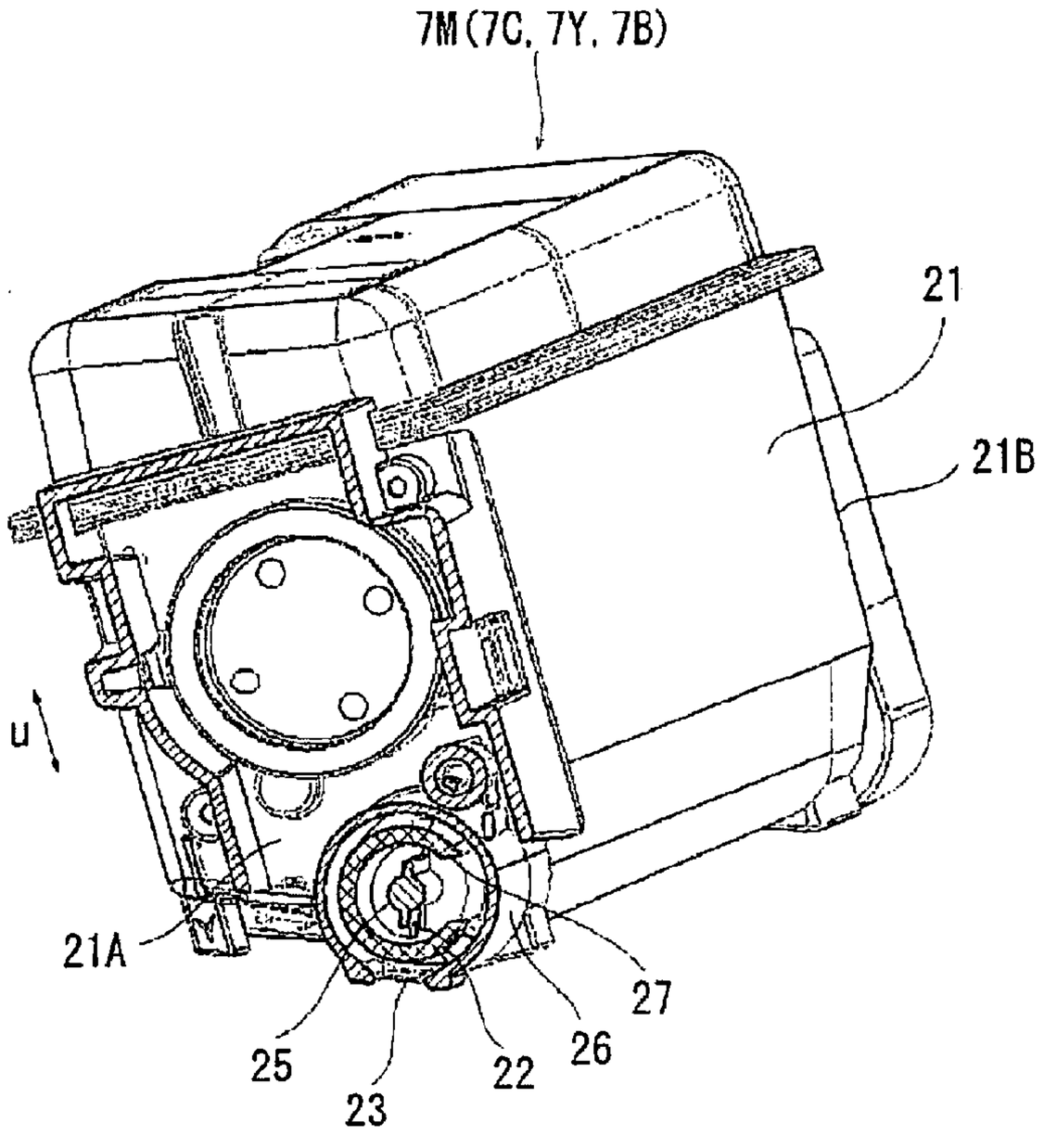

7M(7C, 7Y, 7B)
21
21B
u
21A
27
25
26
22
23

FIG. 4

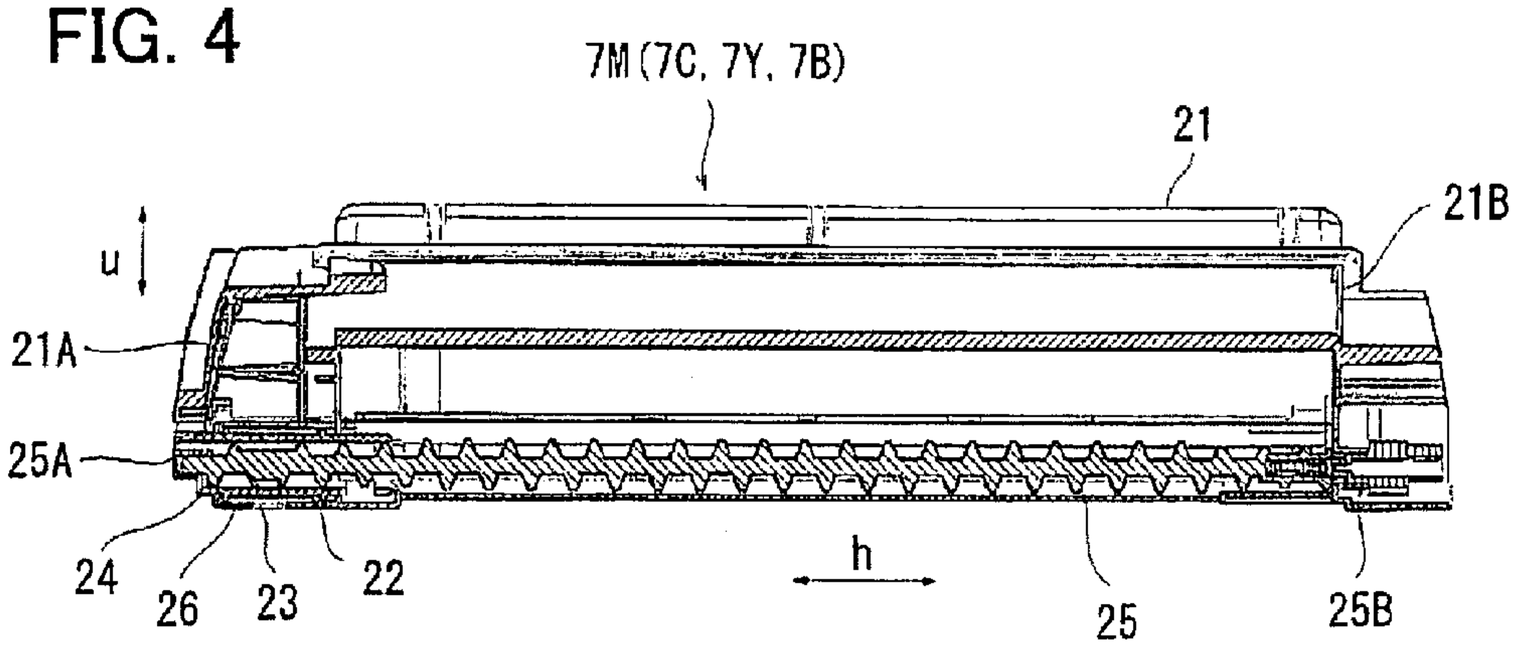

7M(7C, 7Y, 7B)
21
21B
u
21A
25A
24
26
23
22
h
25
25B

FIG. 5

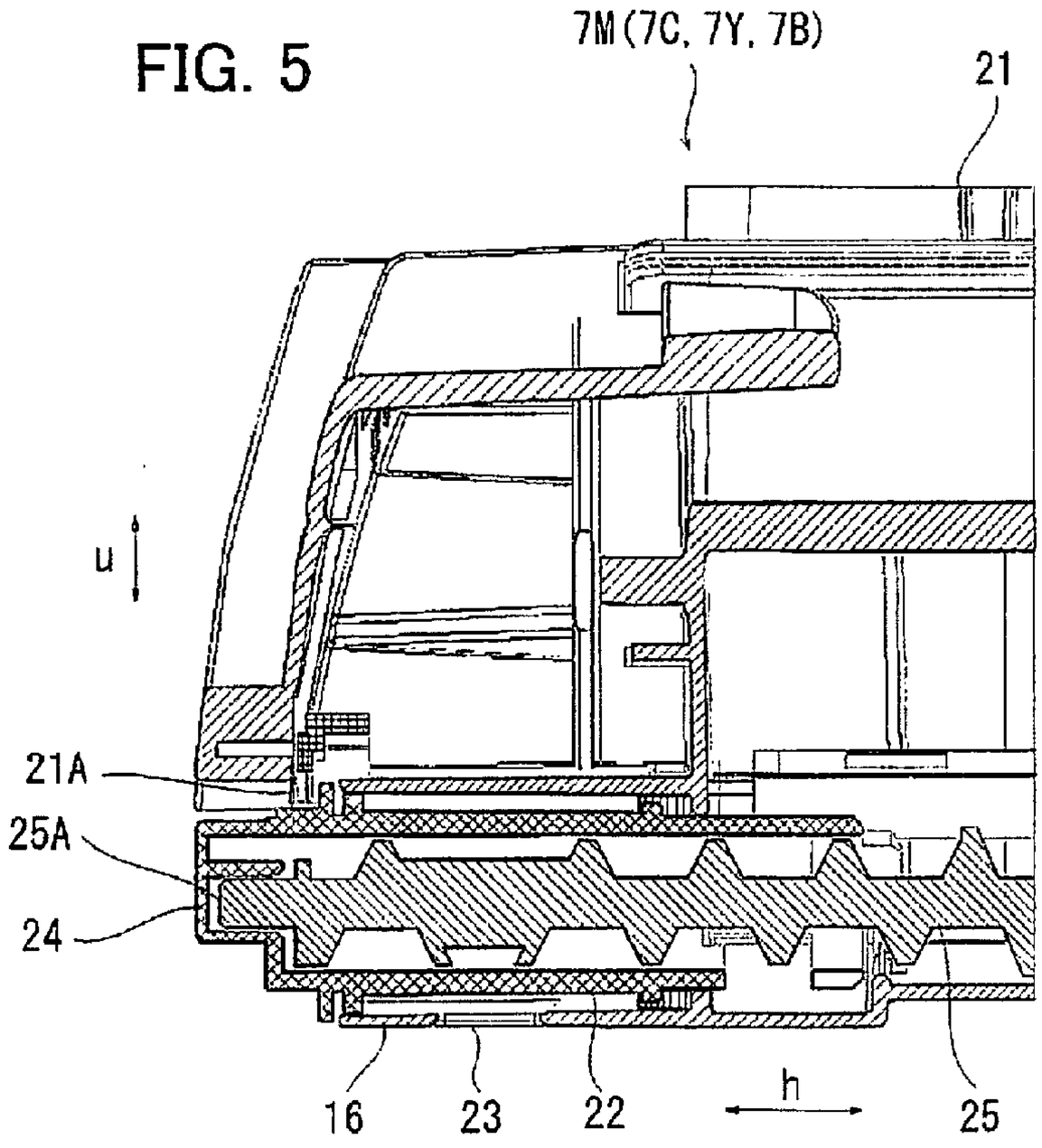

7M(7C, 7Y, 7B)
21
u
21A
25A
24
16
23
22
h
25

FIG. 6

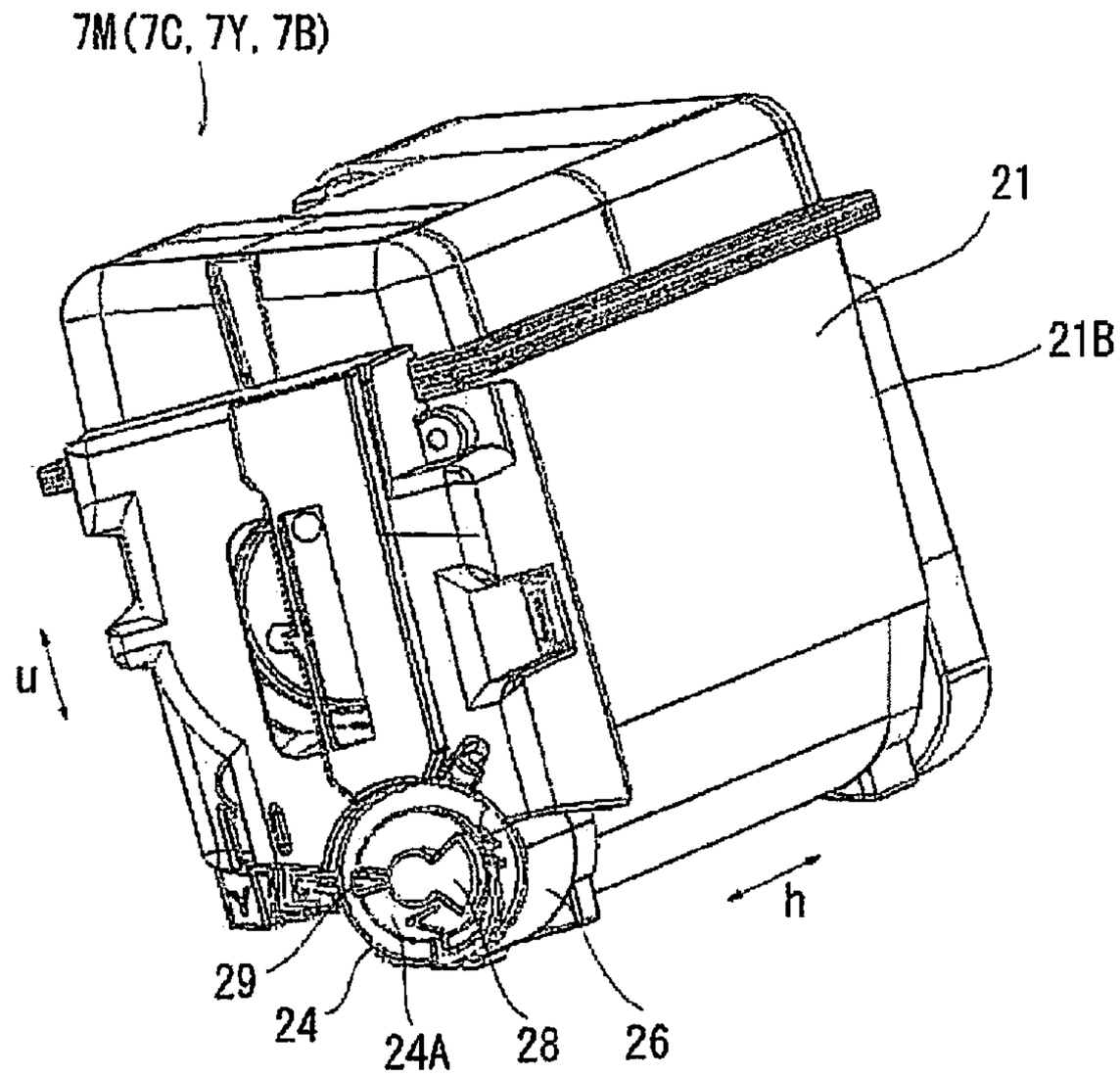


FIG. 7

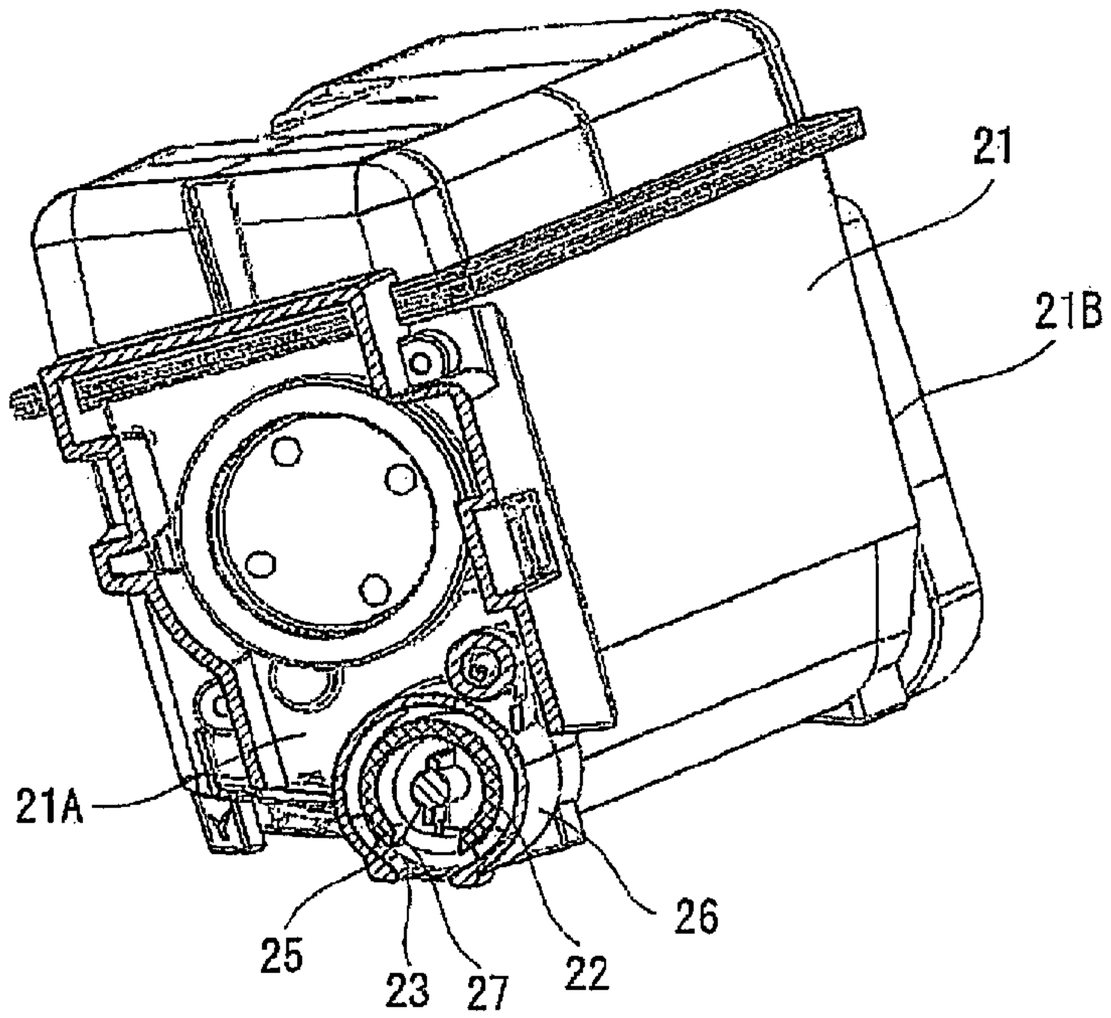


FIG. 8

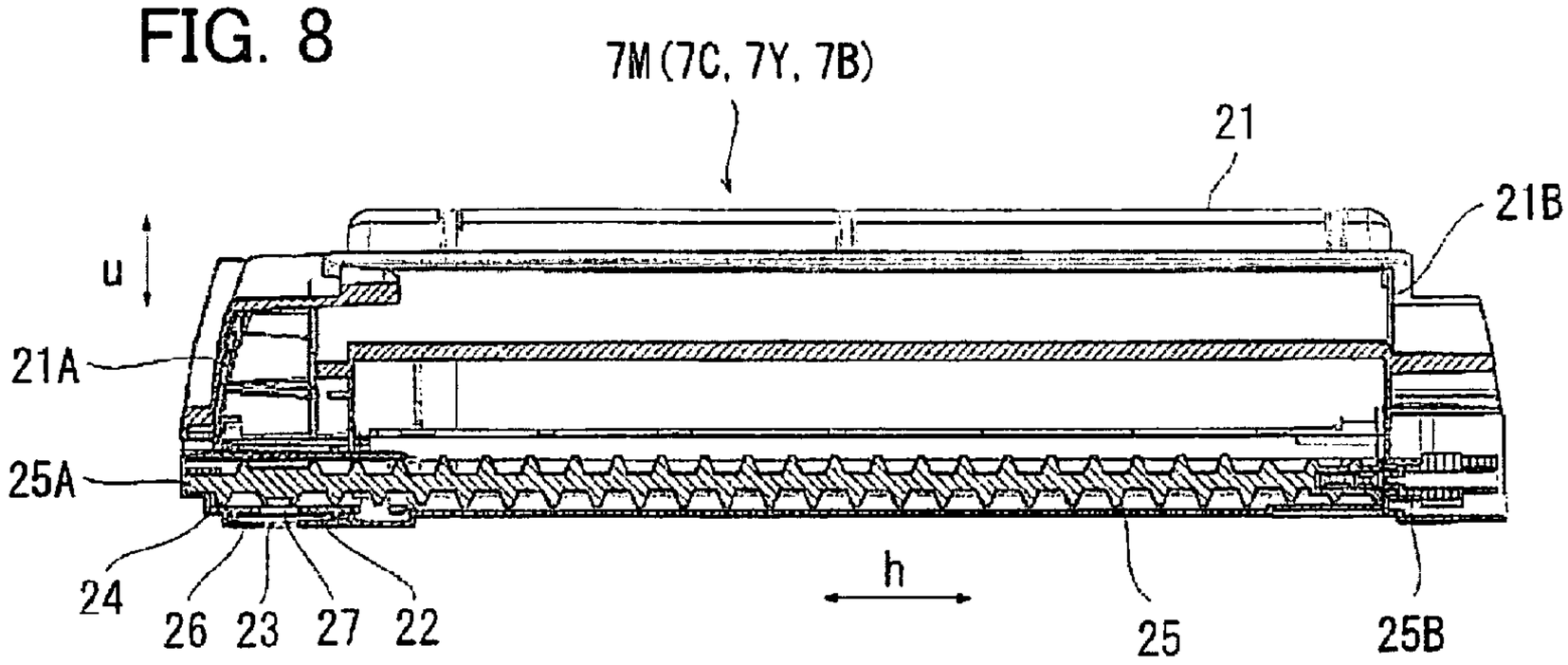

7M(7C, 7Y, 7B)
21
21B
u
21A
25A
24
26
23
27
22
h
25
25B

FIG. 9

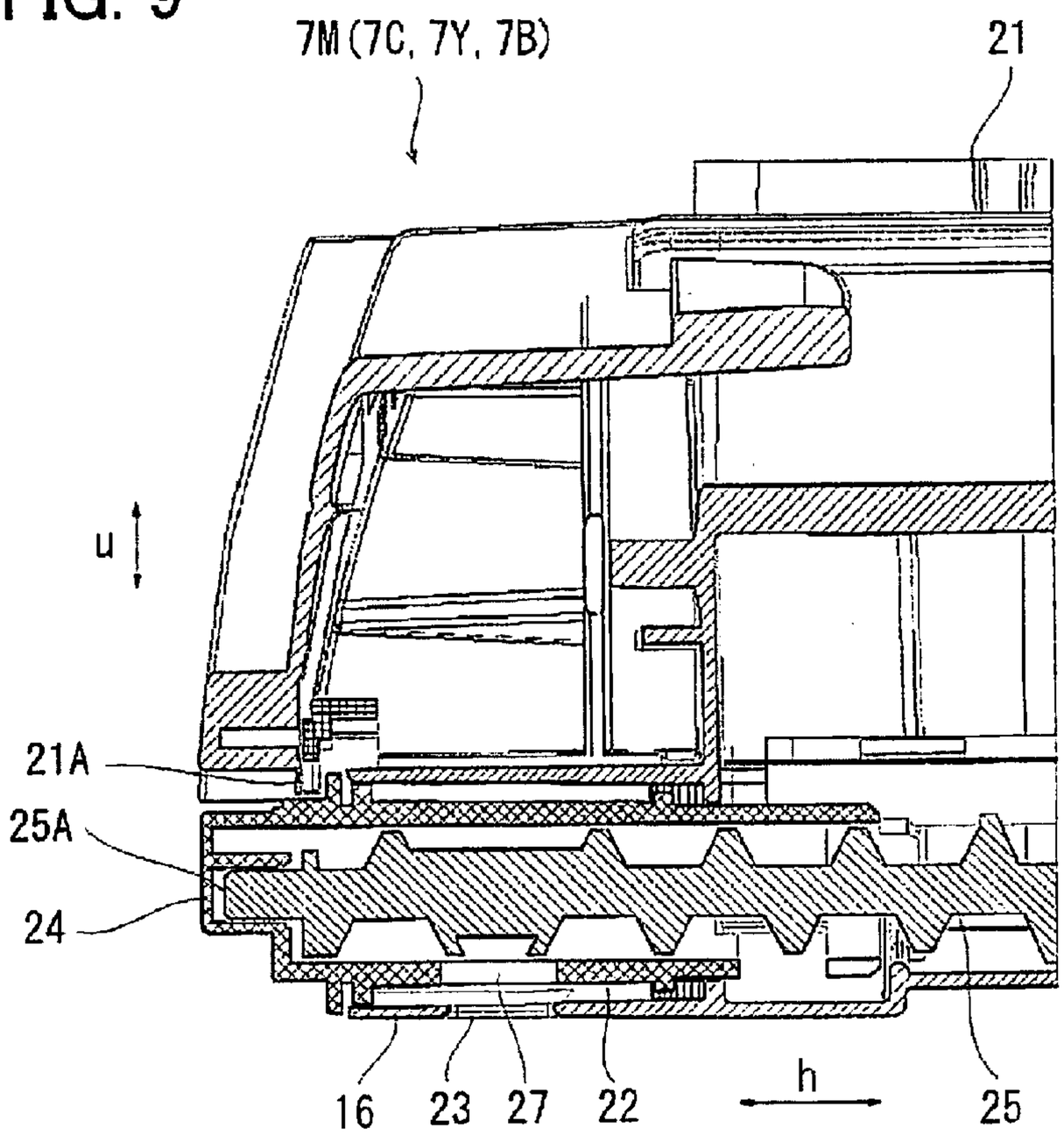

7M(7C, 7Y, 7B)
21
u
21A
25A
24
16
23
27
22
h
25

FIG. 10

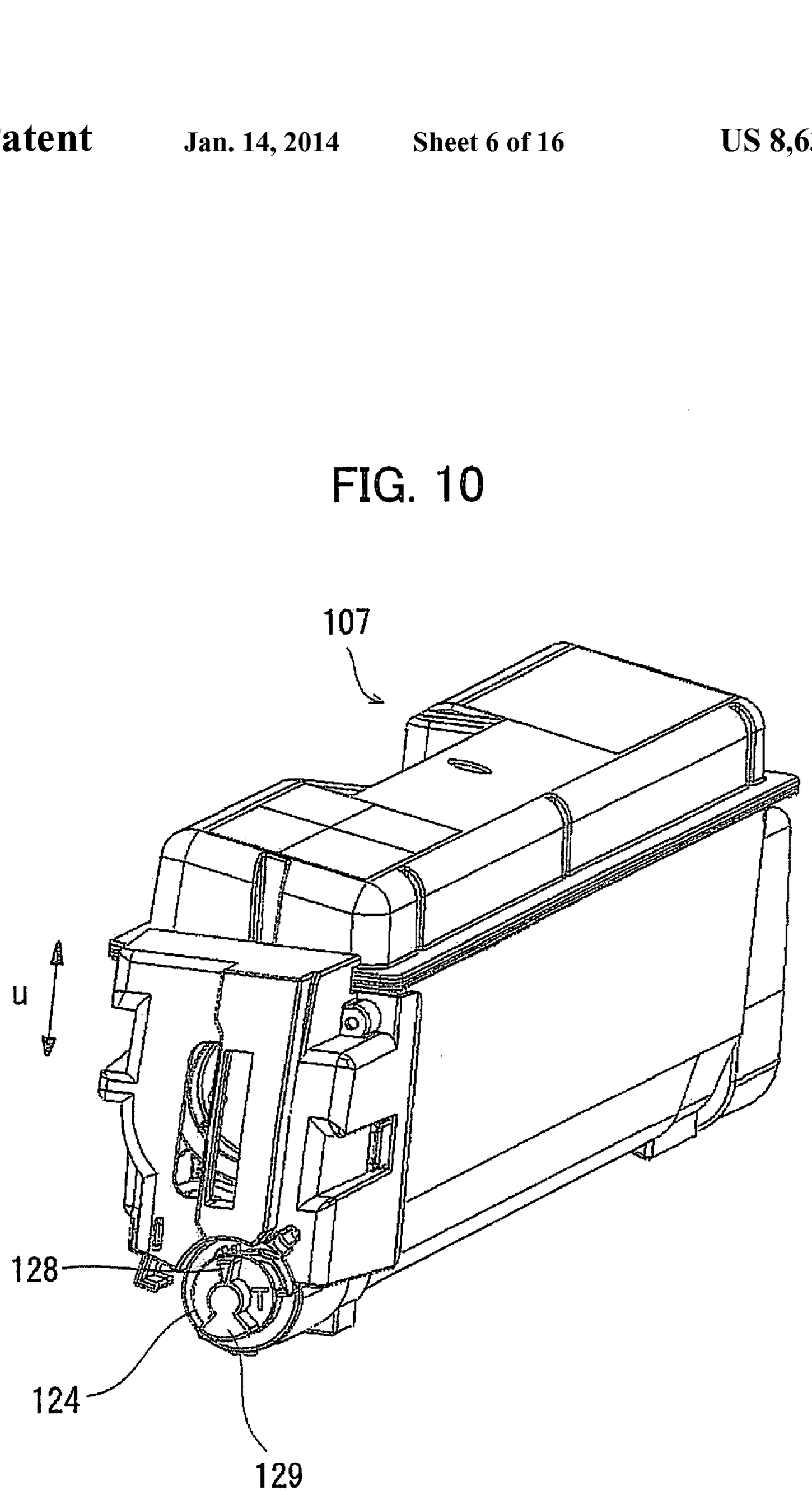


FIG. 11

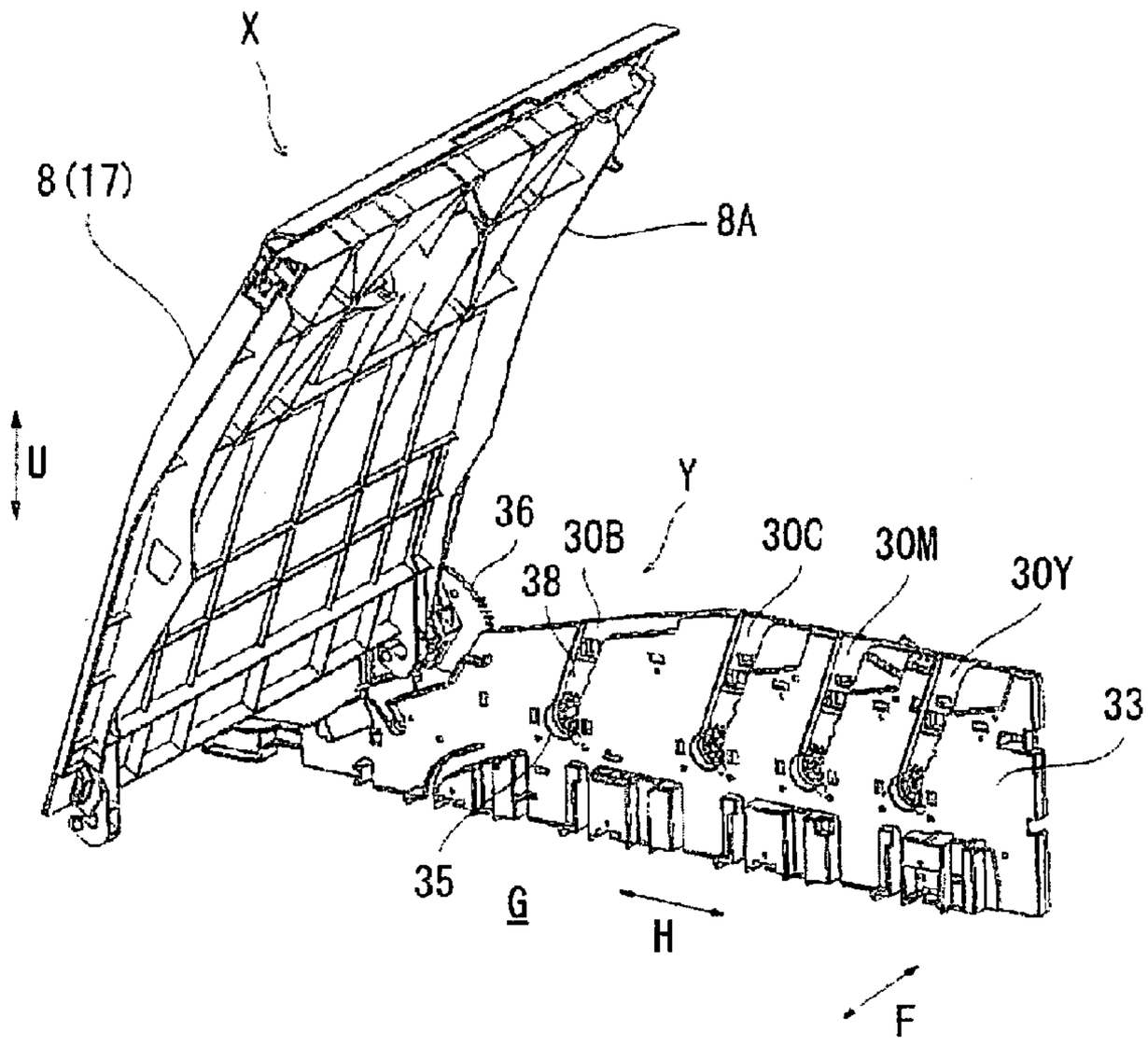


FIG. 12

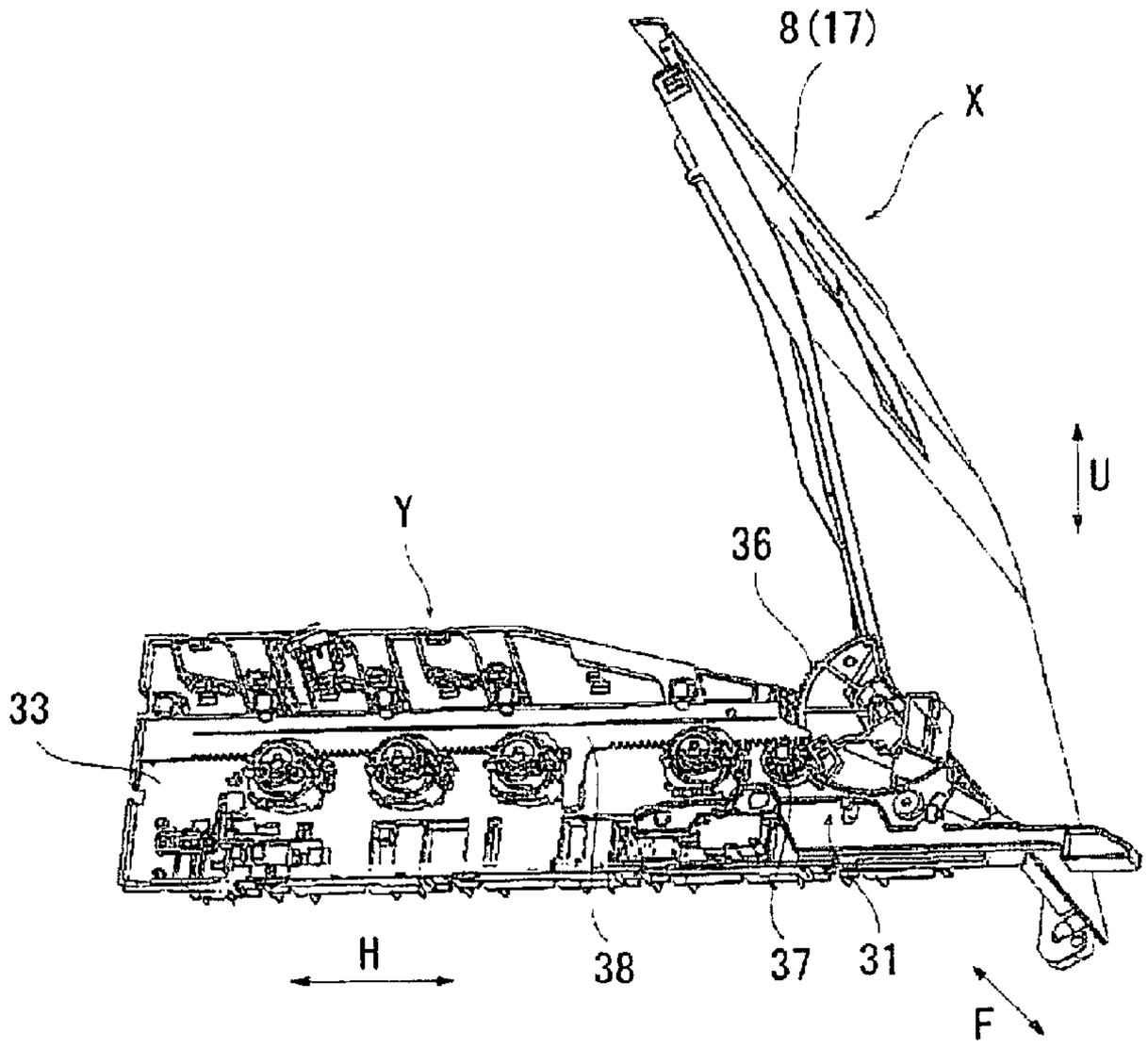


FIG. 13

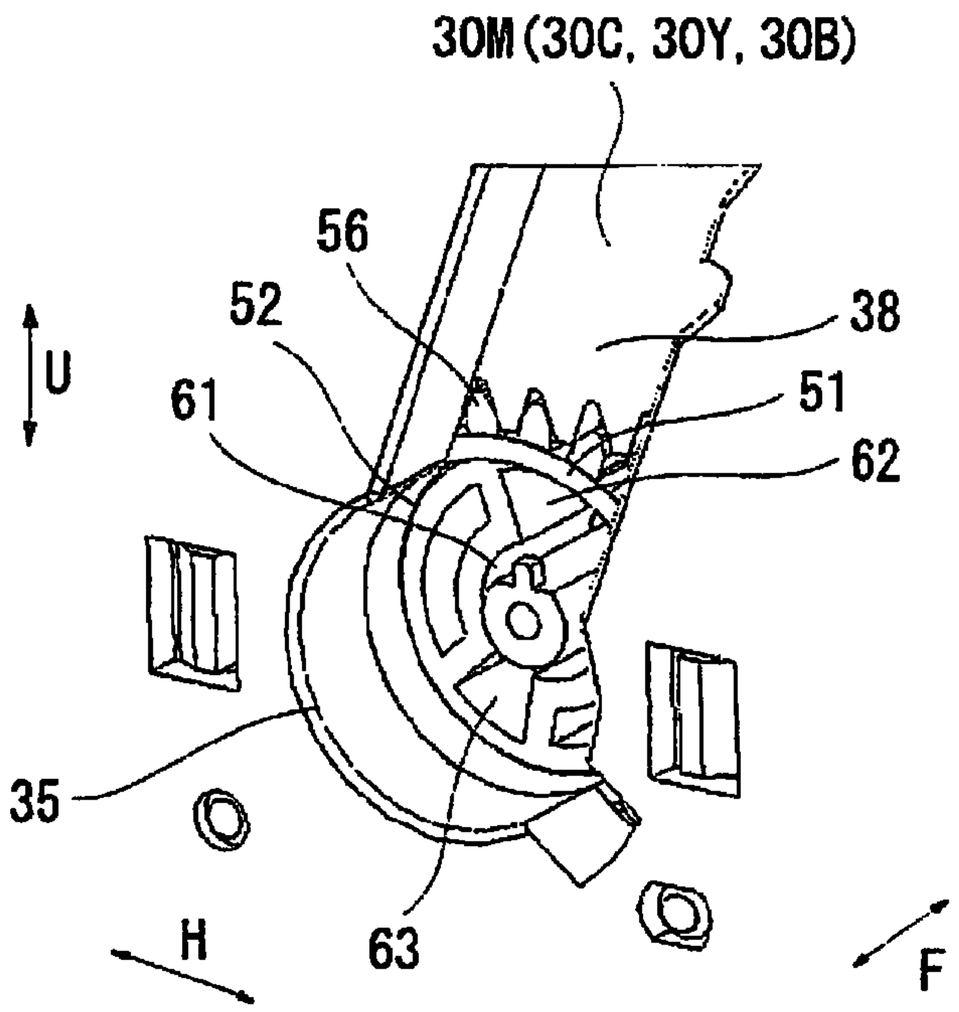

30M (30C, 30Y, 30B)
56
52
38
U
61
51
62
35
63
H
F

FIG. 14

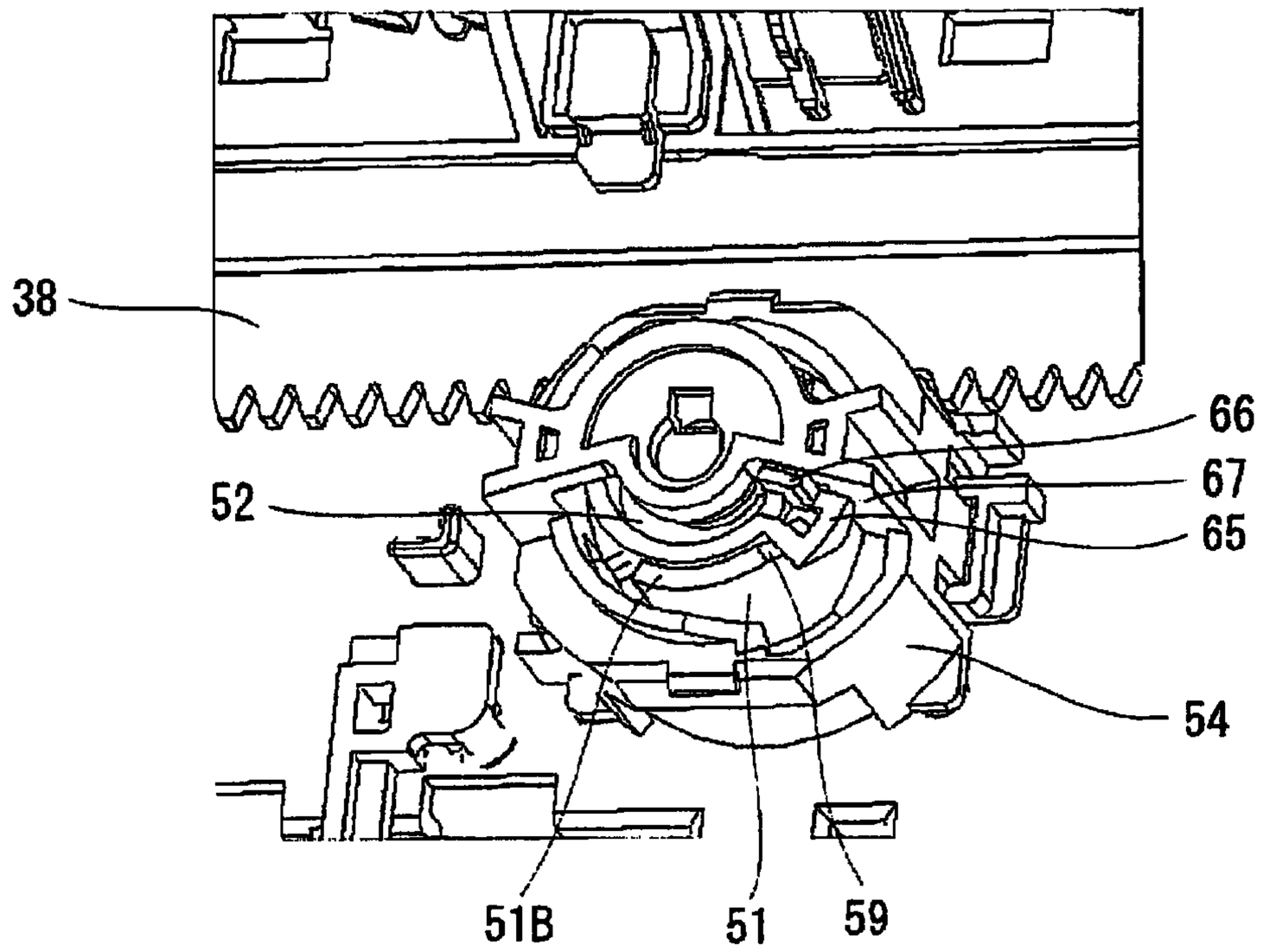
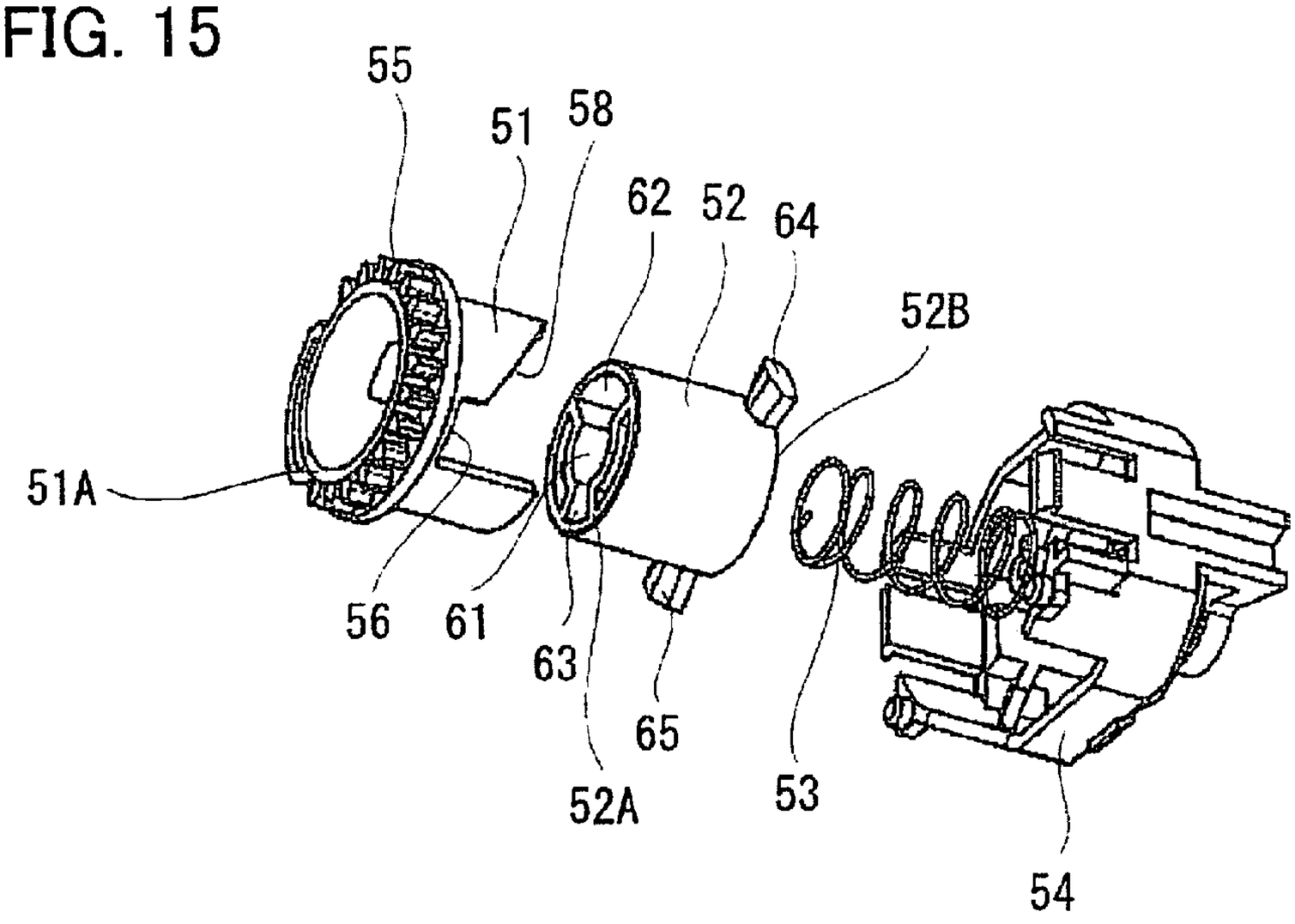

38
66
67
52
65
54
51B
51
59

FIG. 15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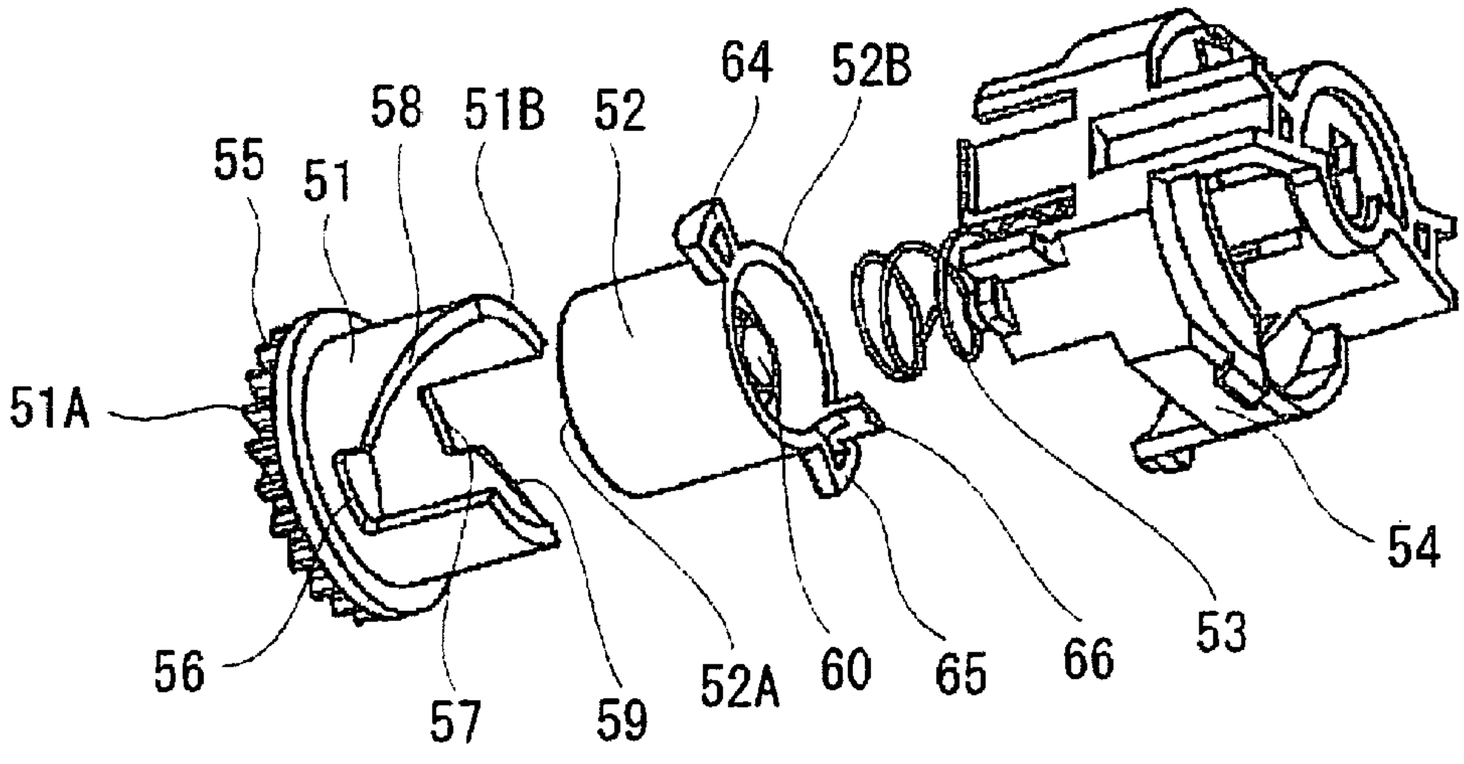
51
58
62
52
64
52B
51A
56
61
63
65
52A
53
54

FIG. 16


64
52B
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51B
52
55
51
51A
56
57
59
52A
60
65
66
53
54

FIG. 17

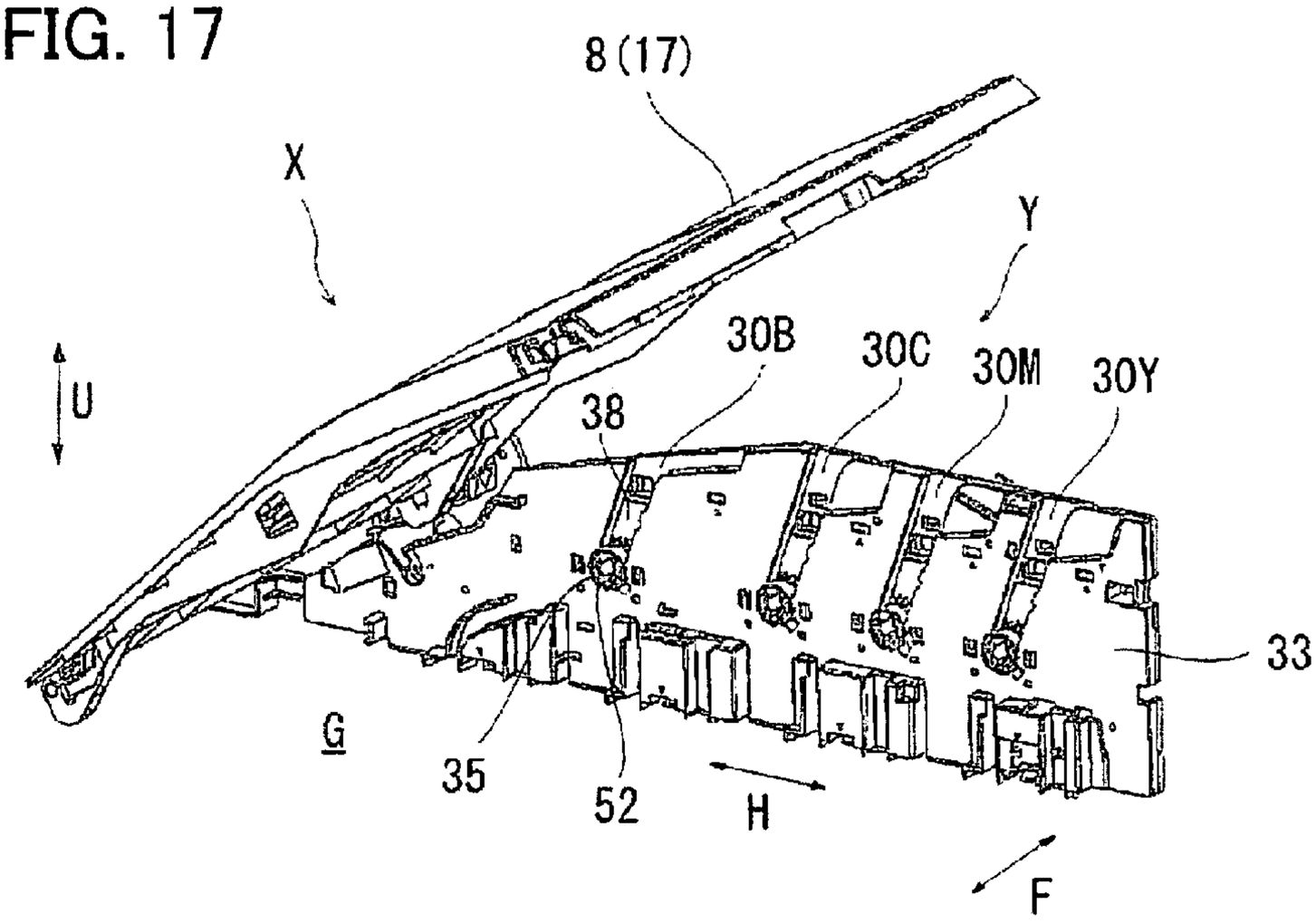


FIG. 18

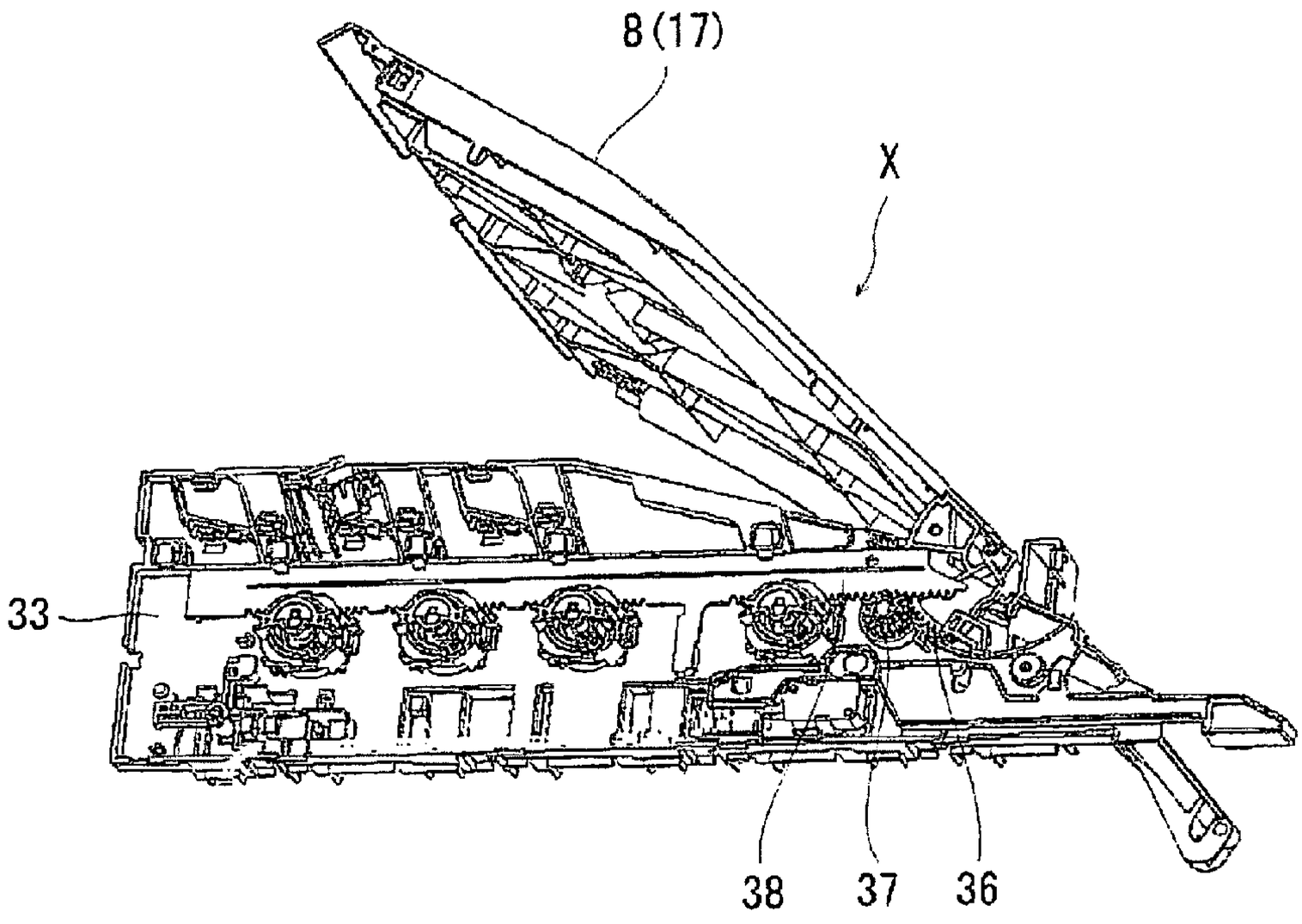


FIG. 19

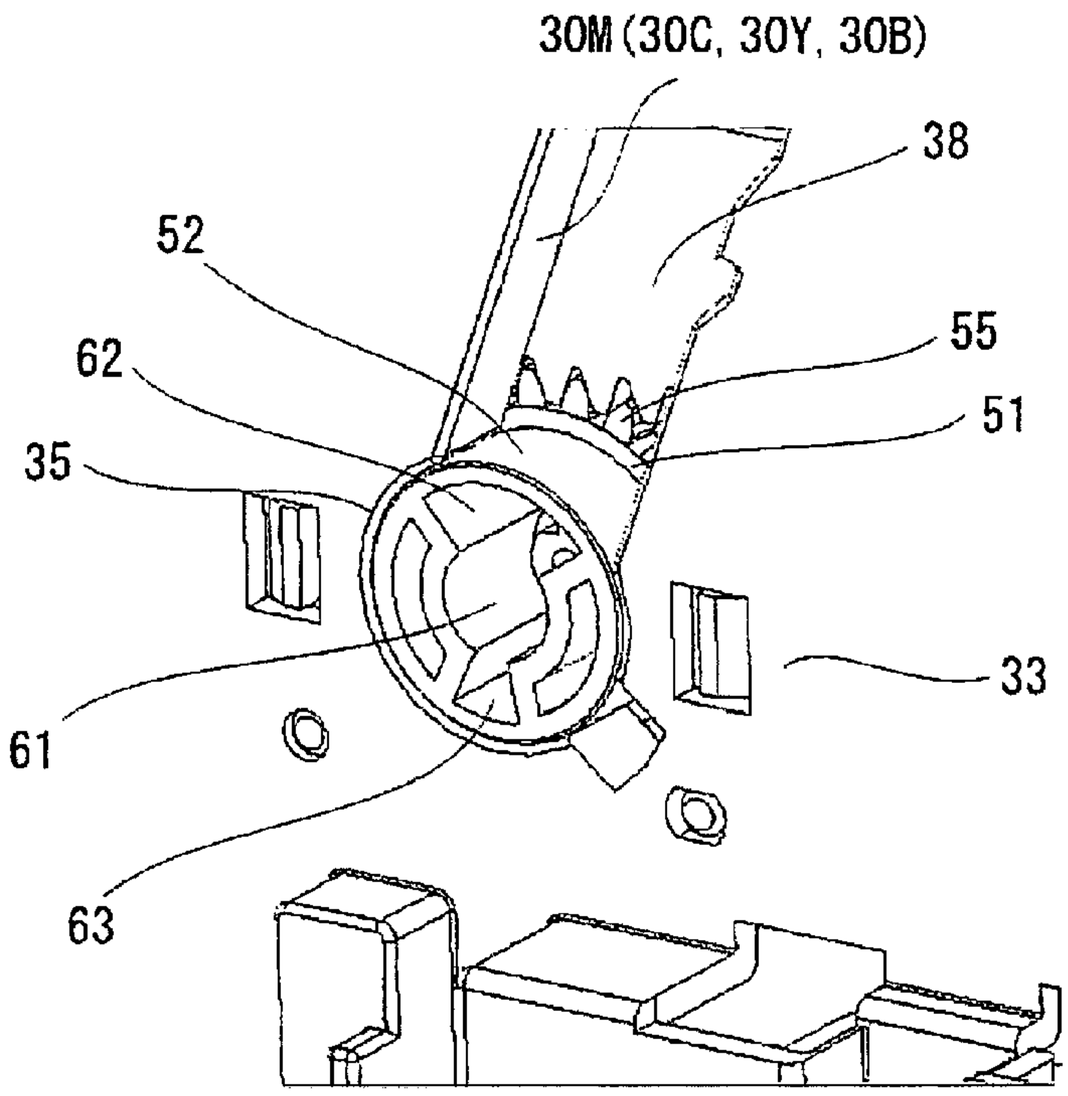


FIG. 20

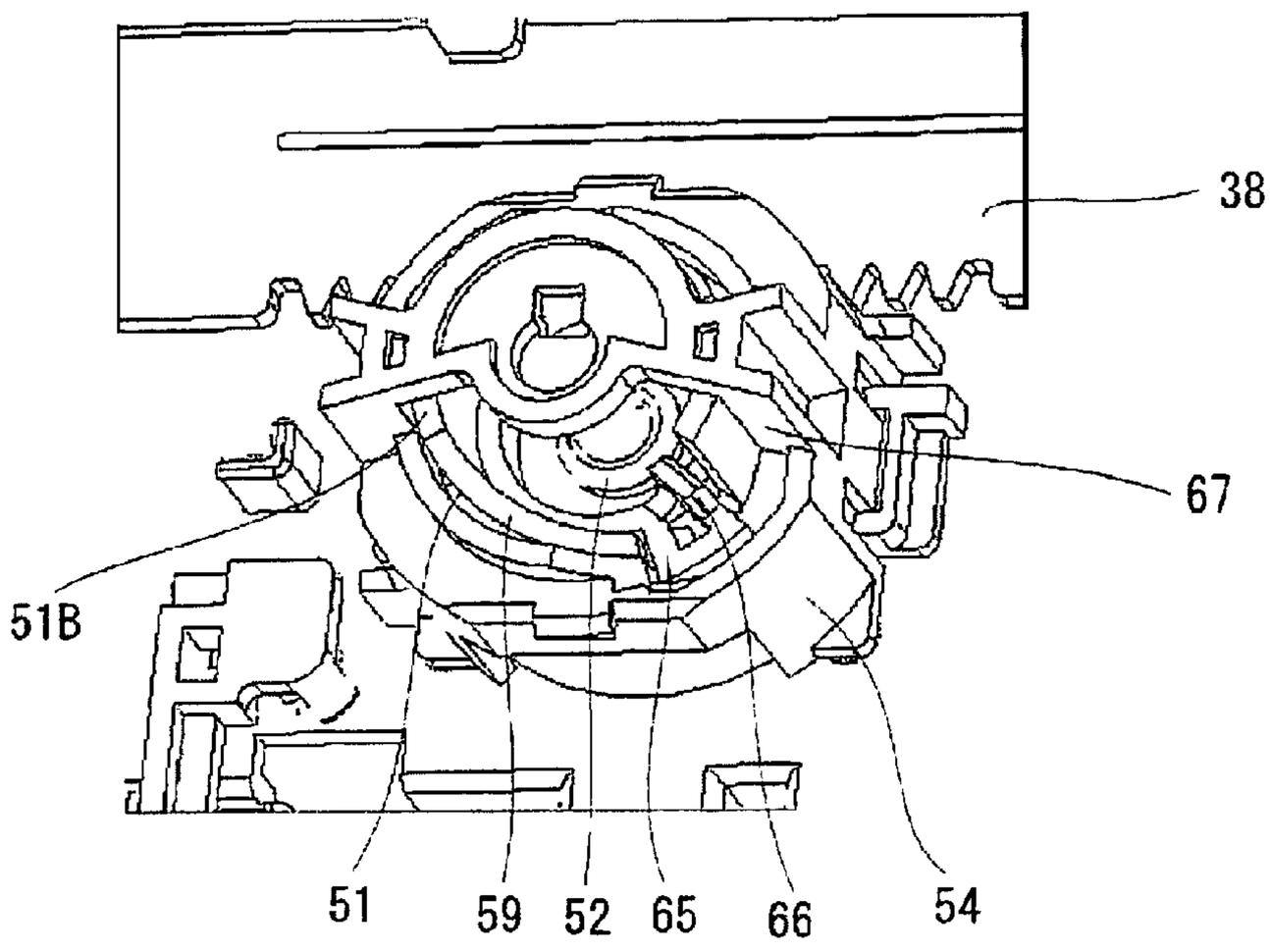


FIG. 21

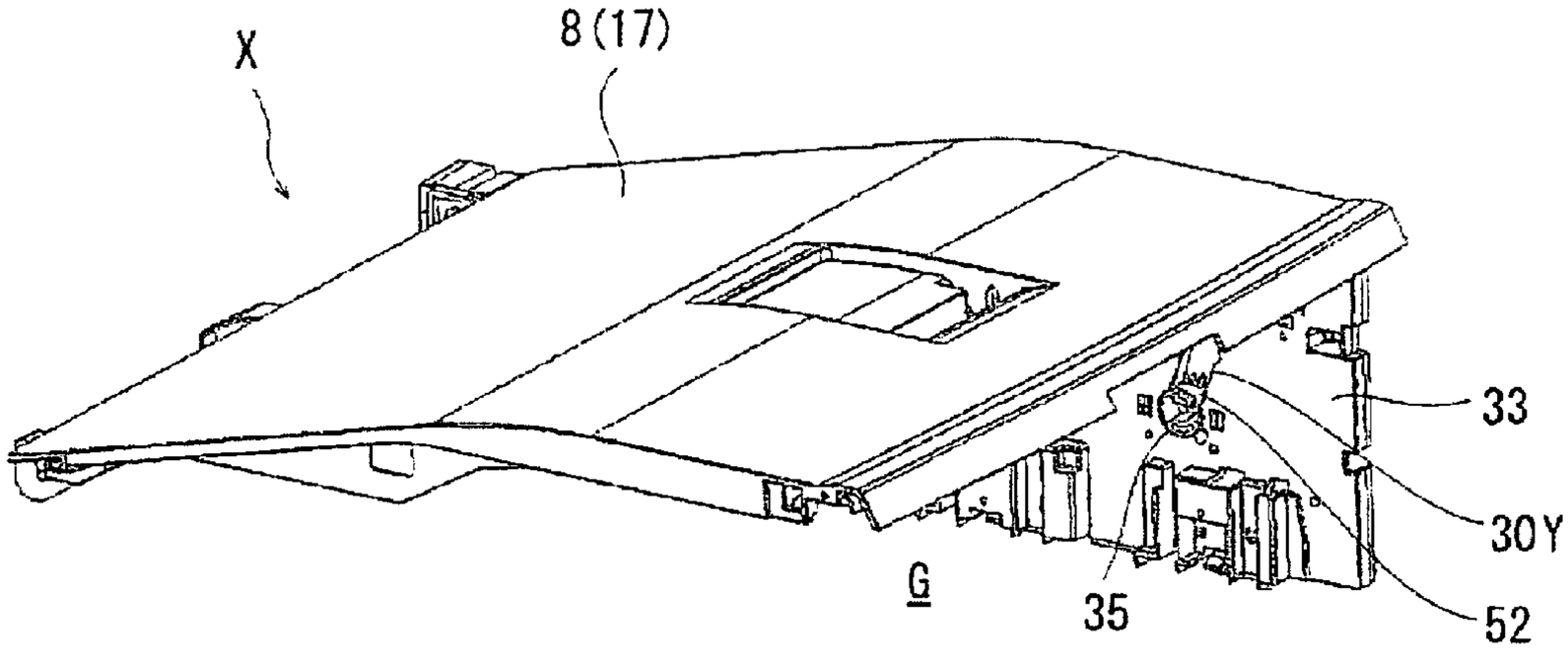


FIG. 22

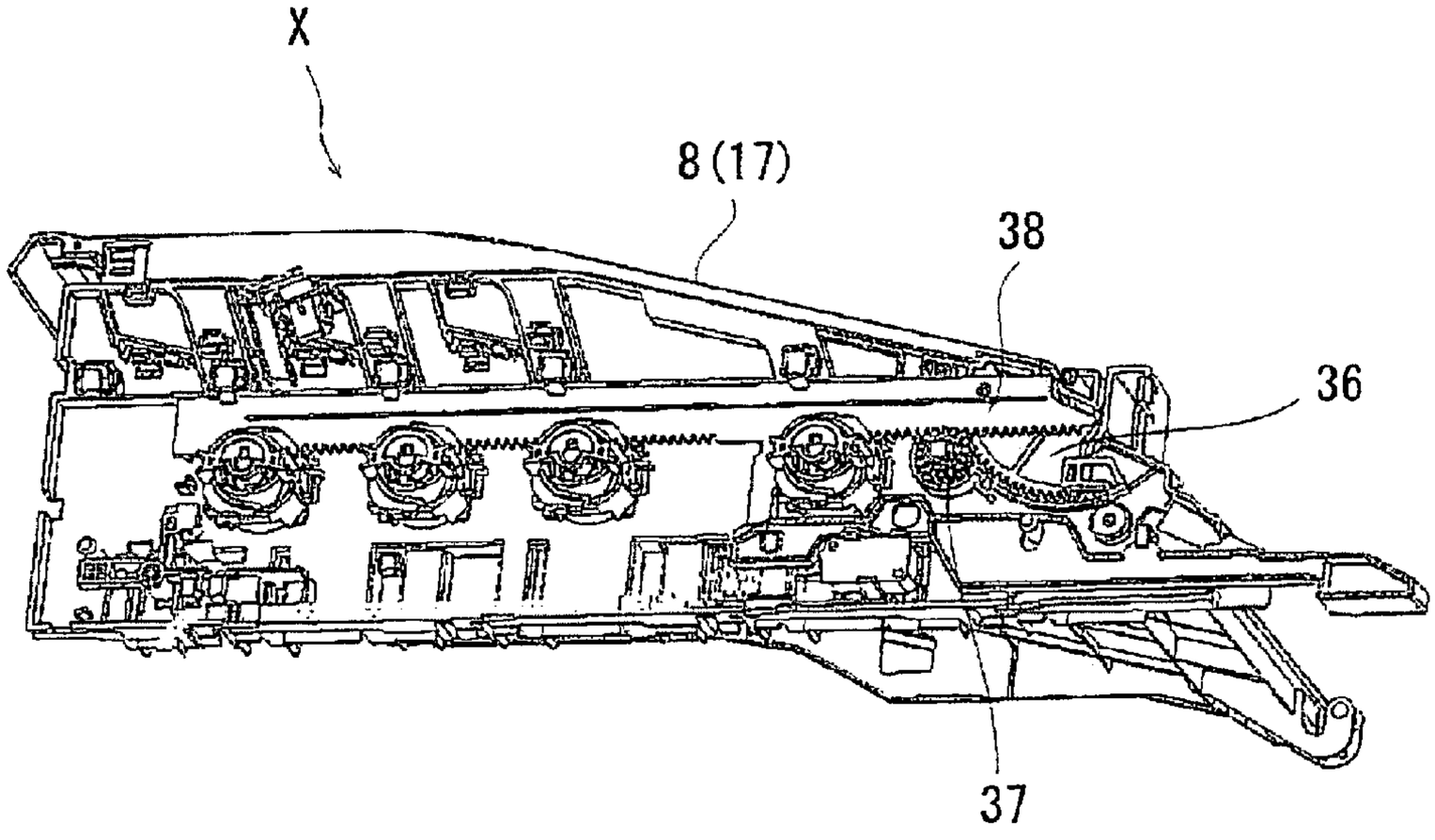


FIG. 23

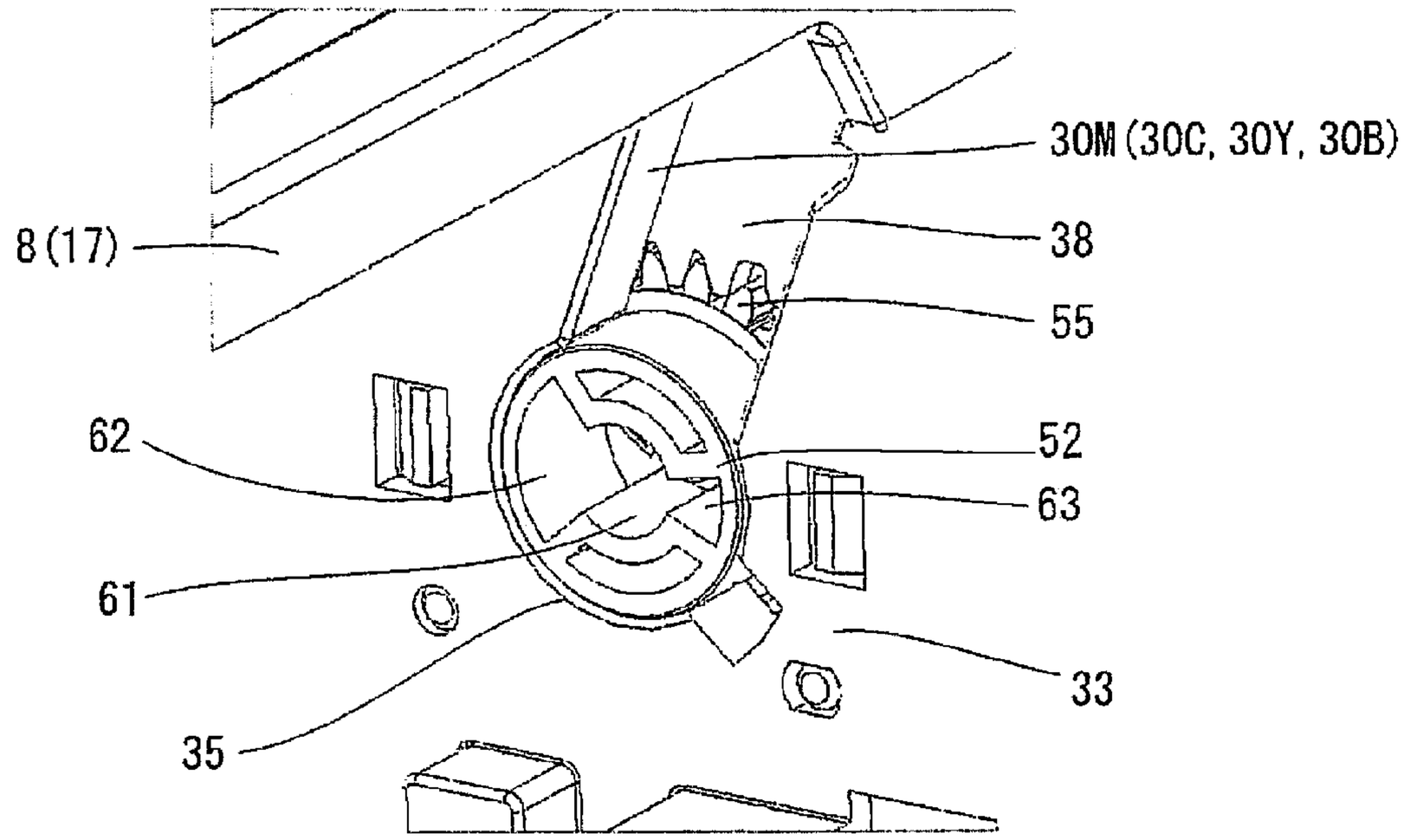
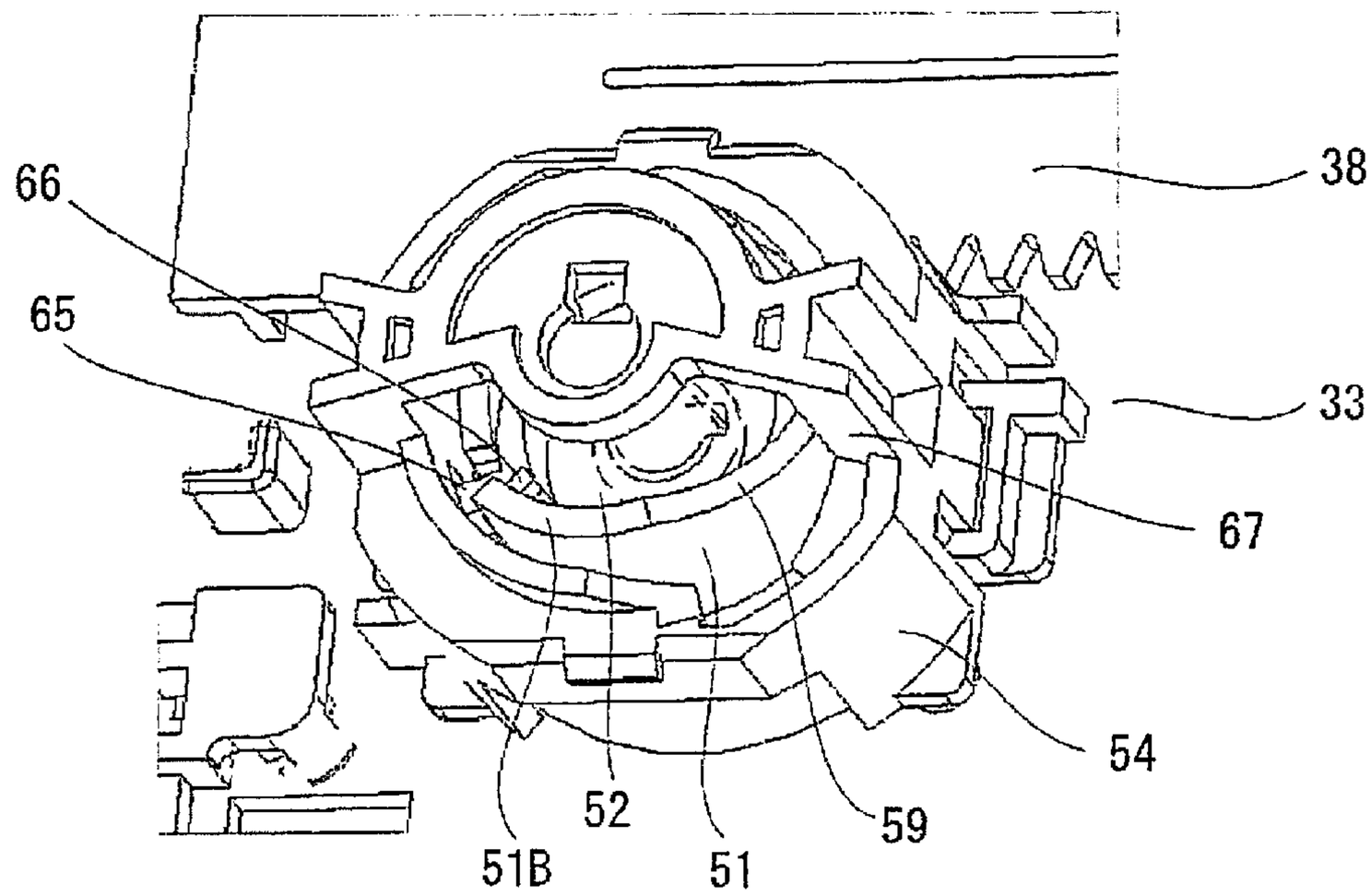

30M (30C, 30Y, 30B)
8 (17)
38
55
62
52
63
61
33
35

FIG. 24


38
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67
54
52
59
51B
51

FIG. 25

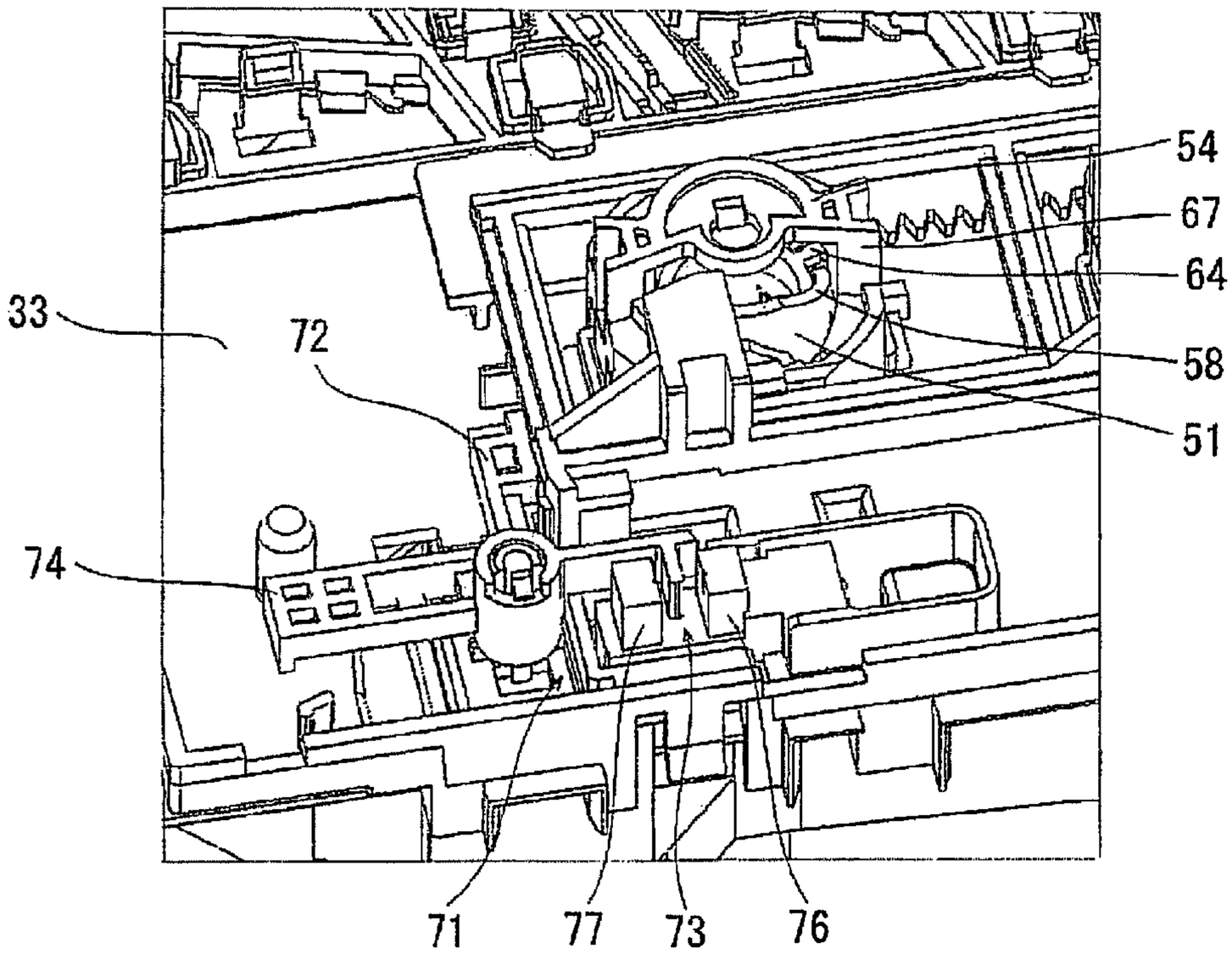

FIG. 26

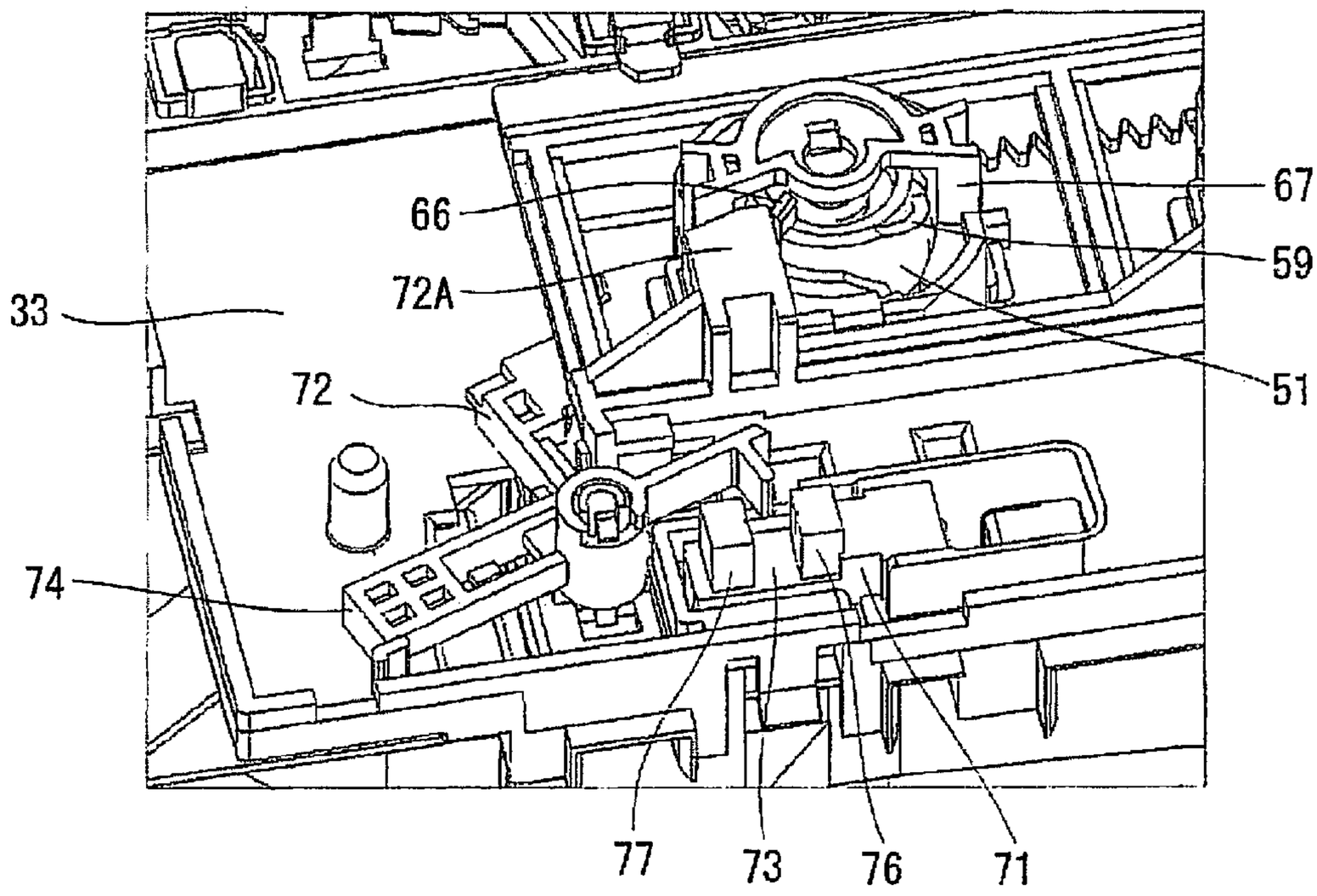

FIG. 27

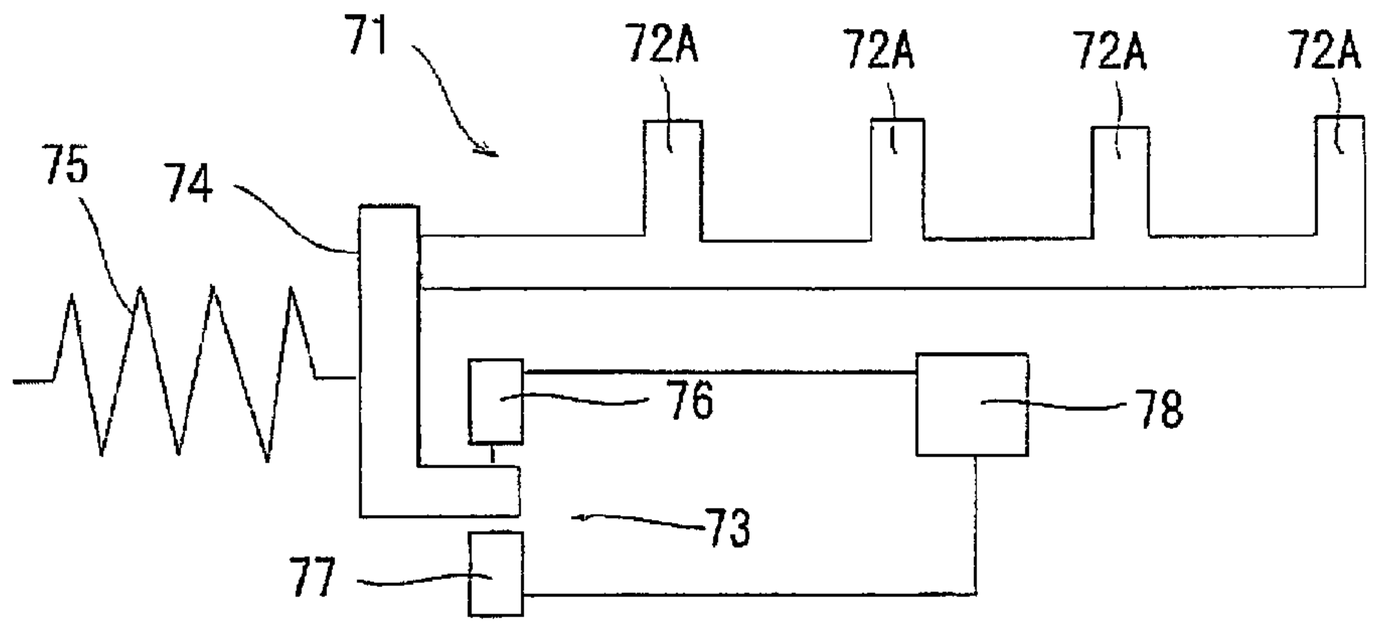
71
72A
72A
72A
72A
75
74
76
78
73
77

FIG. 28

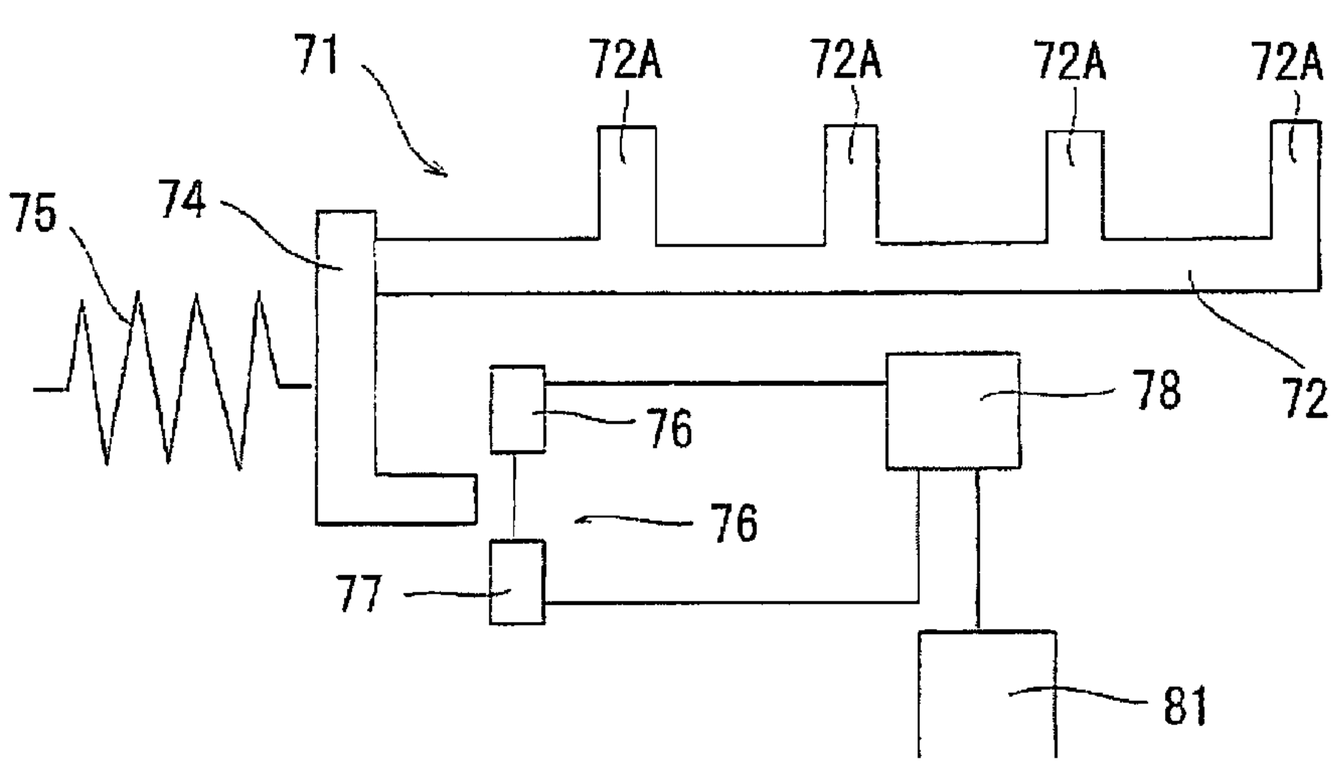
71
72A
72A
72A
72A
75
74
72
78
76
76
77
81

FIG. 29

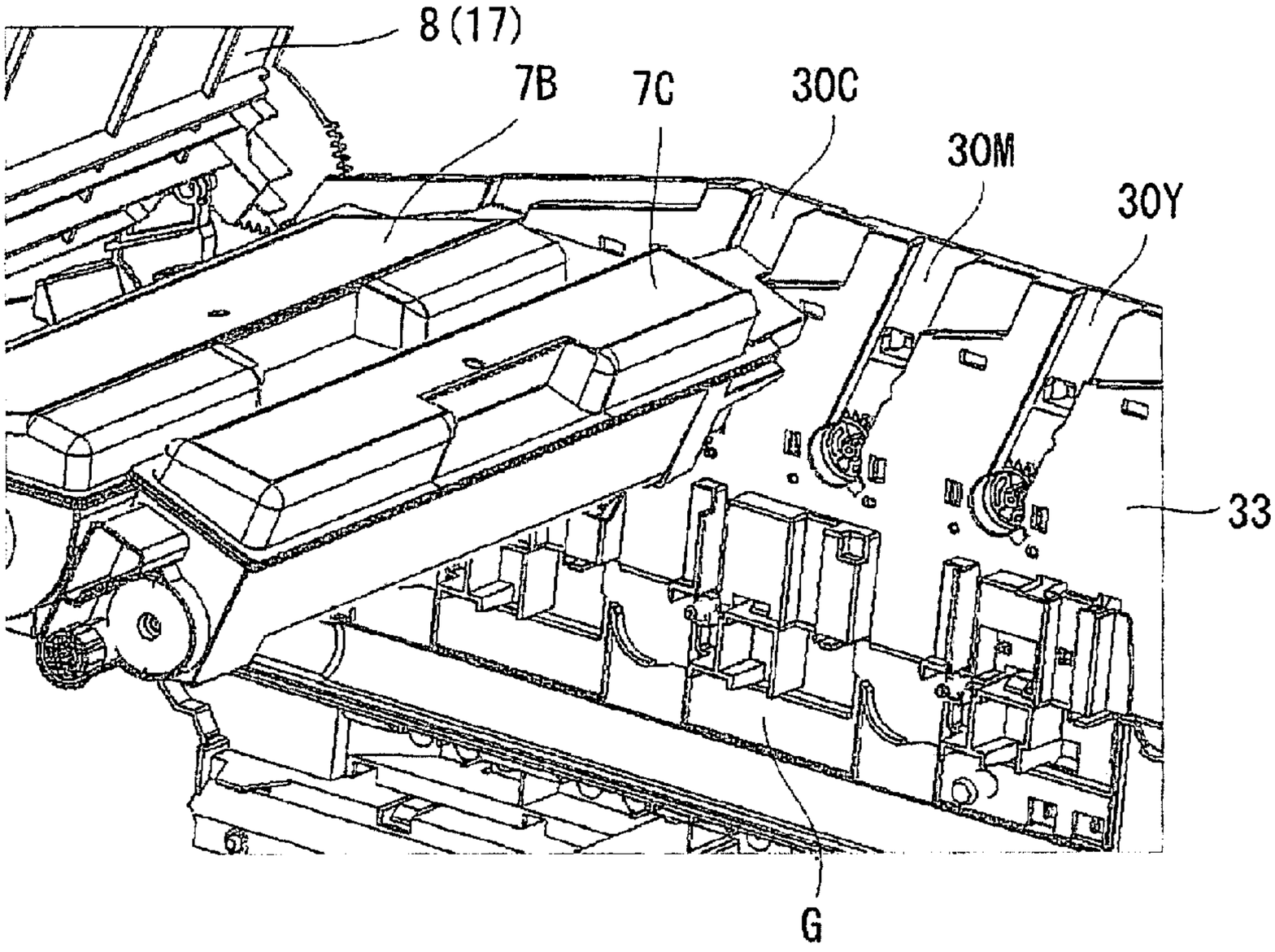

IMAGE FORMING APPARATUS

This application is based on and claims the benefit of priority from Japanese Patent Application No. 2010-125352, filed on 31 May 2010, the content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming apparatus provided with a detachable toner supply device that supplies a toner to an image forming unit.

2. Related Art

An image forming apparatus such as a copy machine, a printer, a facsimile machine, and a multi-functional printer having functions thereof are generally provided with an image forming unit that forms a toner image to be transferred to printing paper. To the image forming unit, a toner is supplied from a toner supply device (toner cartridge).

The toner supply device is configured for each model of the image forming apparatus. A compliant toner supply device for the model of the image forming apparatus is loaded into an installation space in an apparatus main body and supplies a toner to the image forming unit. Therefore, loading of a noncompliant toner supply device to the installation space in the apparatus main body and improper loading of a compliant toner supply device to the installation space (the toner supply device not fully inserted to an loading position) must be avoided.

As a technology for avoiding loading of a noncompliant toner supply device, a technology of forming a joint portion to be inserted into a developer container on a toner supply device of one model and forming a joint portion of a different shape on a toner supply device of another model has been known. In this technology, when a noncompliant toner supply device is loaded into an image forming apparatus, the joint portion thereof cannot be inserted into the developer container. Improper loading of the toner supply device can thus be avoided.

However, in this technology, when a toner supply device is loaded into an image forming apparatus, properness of the toner supply device is determined by physical interference upon insertion of the joint portion into the developer container. It is therefore difficult for an engineer to recognize a noncompliant toner supply device being loaded into the installation space. In addition, if a cover door body is closed in a state in which the noncompliant toner supply device is loaded into the installation space, an unexpected force is applied to the toner supply device and the toner supply device may break. And then, once the cover door body is closed, the engineer cannot recognize that the noncompliant toner supply device is being loaded into the installation space.

SUMMARY OF THE INVENTION

A problem to be solved by the present invention is to provide an image forming apparatus that allows an engineer to easily recognize improper loading of the toner supply device by detecting and notifying loading of a noncompliant toner supply device or improper loading of a compliant toner supply device.

Another problem to be solved by the present invention is to provide an image forming apparatus that allows loading of a noncompliant toner supply device to the installation space and detects and notifies loading of the noncompliant toner supply device after loading, thereby avoiding an unexpected force applied by the cover door body.

The present invention relates to an image forming apparatus including: at least one image forming unit that is disposed in an apparatus main body and forms a toner image; and at least one toner supply device that is loadable and unloadable with respect to an installation space in the apparatus main body and supplies a toner to the image forming unit, in which the toner supply device includes a toner supply opening that is communicatively connected to the image forming unit and an open/close member that opens and closes the toner supply opening, in which the image forming apparatus further comprises: a detection unit that detects, regarding the toner supply device loaded into the installation space, a type of the toner supply device or detects improper loading of the toner supply device; and a notification unit that notifies loading of the toner supply device of a wrong type or improper loading of the toner supply device based on a result of detection by the detection unit.

According to the present invention, a detection unit can detect a type of the toner supply device (compliant or noncompliant) loaded into the installation space or an improper loading of the toner supply device, regardless of recognition by the engineer who loads the toner supply device. By notifying loading of a noncompliant toner supply device or improper loading of a compliant toner supply device based on a result of detection by the detection unit, an engineer can easily recognize improper loading of the toner supply device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view of an image forming apparatus according to the present invention;

FIG. **2** is a perspective view showing a compliant toner supply device with a toner supply opening being in a closed state;

FIG. **3** is a cross-sectional perspective view showing the compliant toner supply device with the toner supply opening being in the closed state;

FIG. **4** is a cross-sectional view showing the compliant toner supply device with the toner supply opening being in the closed state;

FIG. **5** is a cross-sectional enlarged view of FIG. **4**;

FIG. **6** is a perspective view showing the compliant toner supply device with the toner supply opening being in an opened state;

FIG. **7** is a cross-sectional perspective view showing the compliant toner supply device with the toner supply opening being in the opened state;

FIG. **8** is a cross-sectional view showing the compliant toner supply device with the toner supply opening being in the opened state;

FIG. **9** is a cross-sectional enlarged view of FIG. **8**;

FIG. **10** is a perspective view showing a noncompliant toner supply device with a toner supply opening being in a closed state;

FIG. **11** is a front perspective view showing a state in which a cover door body is fully opened and the installation space is exposed;

FIG. **12** is a rear perspective view showing a state in which the cover door body is fully opened and the installation space is exposed;

FIG. **13** is a front perspective view showing a state of a driving coupling joint when the cover door body is fully opened;

FIG. **14** is a rear perspective view showing a state of the driving coupling joint when the cover door body is fully opened;

FIG. **15** is a perspective view showing a constitution of the driving coupling joint;

FIG. **16** is a perspective view showing a constitution of the driving coupling joint;

FIG. **17** is a front perspective view showing a state in which a cover door body is half-opened and the installation space is exposed;

FIG. **18** is a rear perspective view showing a state in which the cover door body is half-opened and the installation space is exposed;

FIG. **19** is a front perspective view showing a state of the driving coupling joint when the cover door body is half-opened;

FIG. **20** is a rear perspective view showing a state of the driving coupling joint when the cover door body is half-opened;

FIG. **21** is a front perspective view showing a state in which the cover door body is closed;

FIG. **22** is a rear perspective view showing a state in which the cover door body is closed;

FIG. **23** is a front perspective view showing a state of the driving coupling joint when the cover door body is closed;

FIG. **24** is a rear perspective view showing a state of the driving coupling joint when the cover door body is closed;

FIG. **25** is a rear perspective view showing a constitution of a detection unit, with a detection subject shielding detection light;

FIG. **26** is a rear perspective view showing a constitution of the detection unit, with a detection subject not shielding the detection light;

FIG. **27** is a schematic view showing a relationship between the detection unit, a control device and a notification unit, with the detection subject of the detection unit shielding the detection light;

FIG. **28** is a schematic view showing a relationship between the detection unit, the control device and the notification unit, with the detection subject of the detection unit not shielding the detection light; and

FIG. **29** is a perspective view showing a state in which the toner supply device is loaded into the installation space.

DETAILED DESCRIPTION OF THE INVENTION

An image forming apparatus of the present invention is described hereinafter with reference to FIGS. **1** to **29**.

Overall Structure of Image Forming Apparatus

An overall structure of the image forming apparatus is described with reference to FIG. **1**.

FIG. **1** is a cross-sectional view of the image forming apparatus according to the present invention.

In FIG. **1**, the image forming apparatus X is configured to include: an apparatus main body **1**; a plurality of image forming units **2**M, **2**C, **2**Y and **2**B; an exposure unit **3**; a secondary transfer unit **5**; a fixing unit **6**; and a plurality of toner supply devices **7**M, **7**C, **7**Y and **7**B.

As shown in FIG. **1**, the apparatus main body **1** has an installation space G with an opening in an upper end thereof in a vertical direction U. The opening of the installation space G is openable and closable by a cover door body **8**. The cover door body **8** is provided in the apparatus main body **1** and rotatably pivotally supported on a first end **1**A side, which is one end in a width direction H of the apparatus main body **1**.

As shown in FIG. **1**, the plurality of image forming units **2**M, **2**C, **2**Y and **2**B is disposed below the installation space G in the vertical direction U of the apparatus main body **1**. Each of the image forming unit **2**M, **2**C, **2**Y and **2**B forms a toner image of magenta, cyan, yellow and black, respectively, and disposed in parallel in the width direction H of the apparatus main body **1**.

As shown in FIG. **1**, each of the image forming unit **2**M, **2**C, **2**Y and **2**B is provided with a photoreceptor drum **9**, a charging device **10**, a developing roller **11** and the like.

The photoreceptor drums **9** of the image forming unit **2**M, **2**C, **2**Y and **2**B are charged at a negative potential by a charging bias of the charging device **10**. In addition, on the photoreceptor drums **9**, electrostatic latent images of magenta, cyan, yellow and black are respectively formed by laser scanning by the exposure unit **3**. As shown in FIG. **1**, the exposure units **3** are disposed below the image forming units **2**M, **2**C, **2**Y and **2**B, respectively.

The developing rollers **11** of the image forming units **2**M, **2**C, **2**Y and **2**B deposit toners of magenta, cyan, yellow and black, respectively, on the electrostatic latent images formed on the photoreceptor drums **9** by a developing bias. The image forming units **2**M, **2**C, **2**Y and **2**B thus form a magenta toner image, a cyan toner image, a yellow toner image and a black toner image, respectively, on the electrostatic latent images on the photoreceptor drums **9**.

The image forming units **2**M, **2**C, **2**Y and **2**B then primarily transfer the toner images on the photoreceptor drums **9** to an intermediate transfer belt **13** by a transfer bias of the primary transfer roller **12**.

As shown in FIG. **1**, the secondary transfer unit **5** is disposed on the first end **1**A side, which is one end of the apparatus main body **1**. The secondary transfer unit **5** is provided with the intermediate transfer belt **13** and a secondary transfer roller **14**.

In the secondary transfer unit **5**, printing paper fed from a paper feeding cassette **15** is nipped by the intermediate transfer belt **13** and the secondary transfer roller **14**, as shown in FIG. **1**. And then, the secondary transfer unit **5** transfers the toner images (the magenta, cyan, yellow and black toner images), which have been primarily transferred to the intermediate transfer belt **13**, to the printing paper by a secondary transfer bias of the secondary transfer roller **14**.

The fixing unit **6** is disposed above the secondary transfer unit **5** in the vertical direction U, as shown in FIG. **1**. The fixing unit **6** is provided with a heating roller **15** and a pressurizing roller **16**.

In the fixing unit **6**, the printing paper fed from the secondary transfer unit **5** is nipped by the heating roller **15** and the pressurizing roller **16**. The fixing unit **6** then heats and pressurizes the printing paper.

The fixing unit **6** thus fixes the toner images (the magenta, cyan, yellow and black toner images), which have been secondarily transferred to the printing paper.

The printing paper onto which the toner images are fixed is ejected to an ejection tray **17** disposed outside the apparatus main body **1**, as shown in FIG. **1**. The ejection tray **17** is composed of the cover door body **8**, as shown in FIG. **1**. The ejection tray **17** doubles as the cover door body **8**.

The plurality of toner supply devices **7**M, **7**C, **7**Y and **7**B are loaded into the installation space G, as shown in FIG. **1**. The toner supply devices **7**M, **7**C, **7**Y and **7**B are disposed in parallel in the width direction H, and communicatively connected to the image forming units **2**M, **2**C, **2**Y and **2**B respectively.

In addition, the toner supply devices **7**M, **7**C, **7**Y and **7**B store toners of magenta, cyan, yellow and black, respectively, and supply the toners to the image forming units **2**M, **2**C, **2**Y and **2**B, respectively.

Specific Structure of Toner Supply Device

Next, a specific structure of the toner supply device is described with reference to FIGS. **2** to **10**.

Specific structures of a compliant toner supply device to be loaded into the image forming apparatus X and a noncompliant toner supply device to be loaded into an image forming apparatus of a different model are described.

1. Specific Structure of Compliant Toner Supply Devices **7**M, **7**C, **7**Y, **7**B

A specific structure of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B is described hereinafter with reference to FIGS. **2** to **9**.

FIG. **2** is a perspective view showing a compliant toner supply device with a toner supply opening being in a closed state. FIG. **3** is a cross-sectional perspective view showing the compliant toner supply device with the toner supply opening being in the closed state. FIG. **4** is a cross-sectional view showing the compliant toner supply device with the toner supply opening being in the closed state. FIG. **5** is a cross-sectional enlarged view of FIG. **4**. FIG. **6** is a perspective view showing the compliant toner supply device with the toner supply opening being in an opened state. FIG. **7** is a cross-sectional perspective view showing the compliant toner supply device with the toner supply opening being in the opened state. FIG. **8** is a cross-sectional view showing the compliant toner supply device with the toner supply opening being in the opened state. FIG. **9** is a cross-sectional enlarged view of FIG. **8**.

The compliant toner supply device **7**M is a toner cartridge that stores a magenta toner, as shown in FIGS. **2** to **5**.

The compliant toner supply device **7**M is provided with a cartridge container **21**, an open/close member **22**, a toner supply opening **23**, and an open/close coupling joint **24** (a compliant open/close joint).

The cartridge container **21** stores a magenta toner, as shown in FIGS. **4** and **5**. Inside the cartridge container **21**, a screw conveyor **25** that feeds the magenta toner to the toner supply opening **23** is disposed. The screw conveyor **25** is positioned below the cartridge container **21** in the vertical direction u. The screw conveyor **25** extends across the width of the cartridge container **21** in the width direction h.

In addition, in the cartridge container **21**, a cylindrical storage body **26** that projects from the first end **21**A in the width direction h is formed, as shown in FIGS. **2** and **3**. The cylindrical storage body **26** has an opening toward the inside of the cartridge container **21**.

The open/close member **22** is formed in a cylindrical shape, as shown in FIGS. **3** to **5**. The open/close member **22** is rotatably disposed from the inside of the cylindrical storage body **26** to the inside of the cartridge container **21**. In the open/close member **22**, a toner ejection opening **27** is opened to connect the inside to the outside of the cylindrical shape, as shown in FIGS. **3**, **8** and **9**. The toner ejection opening **27** extends in the width direction h, as shown in FIGS. **8** and **9**.

As shown in FIGS. **4** and **5**, a first end **25**A of the screw conveyor **25** is disposed inside the open/close member **22**.

The toner supply opening **23** is formed on the cylindrical storage body **26**, as shown in FIGS. **3** to **5**. The toner supply opening **23** is disposed so as to be connectable to the toner ejection opening **27** of the open/close member **22**, as shown in FIGS. **8** and **9**.

The compliant open/close coupling joint **24** is formed in a cylindrical shape with a first end closed, as shown in FIGS. **2**, **4** and **5**. The open/close coupling joint **24** is formed integrally with the open/close member **22**. The open/close coupling joint **24** projects from the first end **21**A of the cartridge container **21**. In addition, the open/close coupling joint **24** blocks a first end of the open/close member **22**, as shown in FIG. **2**.

The compliant open/close coupling joint **24** has a plurality of fan-shaped connecting parts **28**, **29**, as shown in FIG. **2**. The fan-shaped connecting parts **28**, **29** are formed integrally with a closed end **24**A of the open/close coupling joint **24** so as to project from the closed end **24**A. In addition, the fan-shaped connecting parts **28**, **29** are disposed at an interval of 180 degrees along a circumference of the open/close coupling joint **24**, as shown in FIG. **2**.

The fan-shaped connecting part **28** is positioned upward in the vertical direction u, as shown in FIG. **2**. The fan-shaped connecting part **29** is positioned downward in the vertical direction u. A width of the fan-shaped connecting part **28** is larger than a width of the fan-shaped connecting part **29** (fan-shaped connecting part **28**>fan-shaped connecting part **29**).

The open/close coupling joint **24** rotatably pivotally supports the first end **25**A of the screw conveyor **25**, as shown in FIGS. **4** and **5**. A second end **25**B of the screw conveyor **25** is rotatably pivotally supported on a side of a second end **21**B of the cartridge container **21**, as shown in FIG. **4**.

In the compliant toner supply device **7**M thus configured, the toner supply opening **23** can be switched from a closed state shown in FIGS. **2** to **5** to an opened state shown in FIGS. **6** to **9**, by rotating the open/close coupling joint **24** and the open/close member **22** in a clockwise direction. When the toner supply opening **23** is in the closed state, the toner supply opening **23** is closed with the open/close member **22** as shown in FIGS. **3** to **5**. When the toner supply opening **23** is in the opened state, the toner supply opening **23** is opened in such a way that the toner ejection opening **27** of the open/close member **22** faces the toner supply opening **23**, as shown in FIGS. **6** to **9**.

The compliant toner supply device **7**M thus supplies the magenta toner fed by the screw conveyor **25** from the toner supply opening **23** through the toner ejection opening **27**, as shown in FIGS. **6** to **9**.

In addition, in the compliant toner supply device **7**M, the toner supply opening **23** is switched from the opened state to the closed state by rotating the open/close coupling joint **24** and the open/close member **22** in a counterclockwise direction, as shown in FIG. **6**.

The compliant toner supply devices **7**C, **7**Y and **7**B of cyan, yellow and black have the same structure as the magenta toner supply device **7**M shown in FIGS. **2** to **9**, and therefore a detailed description thereof is omitted. In the toner supply devices **7**C, **7**Y and **7**B, toners of cyan, yellow and black are stored in the cartridge containers **21**, as shown in FIG. **2**.

2. Specific Structure of Noncompliant Toner Supply Device **107**

Next, a specific structure of the noncompliant toner supply device **107** is described with reference to FIG. **10**.

FIG. **10** is a perspective view showing a noncompliant toner supply device with a toner supply opening being in a closed state. In FIG. **10**, similar components to those shown in FIGS. **2** to **9** are referred to by the same numerals and descriptions thereof are omitted.

The noncompliant toner supply device **107** has the same configuration as the compliant toner supply device **7**M, except for a plurality of fan-shaped connecting parts **128**, **129** of a noncompliant open/close coupling joint **124** (a noncompliant open/close joint), as shown in FIG. **10**.

In the noncompliant open/close coupling joint **124**, the plurality of fan-shaped connecting parts **128**, **129** are disposed at an interval of 180 degrees along a circumference of the open/close coupling joint **124**, as shown in FIG. **10**. The

fan-shaped connecting part **128** is positioned upward in the vertical direction u, as shown in FIG. **10**. The fan-shaped connecting part **129** is positioned downward. A width of the fan-shaped connecting part **128** is smaller than a width of the fan-shaped connecting part **129** (fan-shaped connecting part **128**<fan-shaped connecting part **129**).

The widths of the noncompliant fan-shaped connecting parts **128**, **129** shown in FIG. **10** are configured upside down compared to that of the compliant fan-shaped connecting parts **28**, **29** shown in FIG. **2**.

Specific Structure of Open/Close Driving Unit

Next, a specific structure of an open/close driving unit is described with reference to FIGS. **11** to **24**.

An open/close driving unit Y switches the toner supply opening **23** of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B shown in FIGS. **2** to **9** between the opened and closed states.

FIG. **11** is a front perspective view showing a state in which a cover door body is fully opened and the installation space is exposed. FIG. **12** is a rear perspective view showing a state in which the cover door body is fully opened and the installation space is exposed. FIG. **13** is a front perspective view showing a state of a driving coupling joint when the cover door body is fully opened. FIG. **14** is a rear perspective view showing a state of the driving coupling joint when the cover door body is fully opened. FIG. **15** is a perspective view showing a constitution of the driving coupling joint. FIG. **16** is a perspective view showing a constitution of the driving coupling joint. FIG. **17** is a front perspective view showing a state in which a cover door body is half-opened and the installation space is exposed. FIG. **18** is a rear perspective view showing a state in which the cover door body is half-opened and the installation space is exposed. FIG. **19** is a front perspective view showing a state of the driving coupling joint when the cover door body is half-opened. FIG. **20** is a rear perspective view showing a state of the driving coupling joint when the cover door body is half-opened. FIG. **21** is a front perspective view showing a state in which the cover door body is closed. FIG. **22** is a rear perspective view showing a state in which the cover door body is closed. FIG. **23** is a front perspective view showing a state of the driving coupling joint when the cover door body is closed. FIG. **24** is a rear perspective view showing a state of the driving coupling joint when the cover door body is closed.

The open/close driving unit Y is composed of: the cover door body **8**; a plurality of guide grooves **30**M, **30**C, **30**Y and **30**B; a gear transmission structure **31**; and a driving coupling joint **32** (driving joint), as shown in FIGS. **11** to **16**.

The cover door body **8** is rotatably pivotally supported by both side wall panels **33**, **34** (the side wall panel **34** not illustrated), which form the installation space G, of the apparatus main body **1**, thereby opening and closing the installation space G, as shown in FIGS. **11** and **12**.

The plurality of guide grooves **30**M, **30**C, **30**Y and **30**B are formed on the side wall panel **33** of the apparatus main body **1**, as shown in FIG. **11**. The plurality of guide grooves **30**M, **30**C, **30**Y and **30**B are arranged at intervals in the width direction H of the apparatus main body **1**. The guide grooves **30**M, **30**C, **30**Y and **30**B open toward the opening and the inside of the installation space G and extend downward in the vertical direction U. In addition, in a lower end of each of the guide grooves **30**M, **30**C, **30**Y and **30**B, a driving receiver hole **35** is formed, as shown in FIGS. **11** and **13**. The driving receiver hole **35** penetrates the side wall panel **33** in a depth direction F of the apparatus main body **1**.

The gear transmission structure **31** is disposed on a reverse side of the side wall panel **33**, as shown in FIGS. **12** and **14**. The gear transmission structure **31** is provided with a fan-shaped gear **36**, a pinion gear **37**, and a rack gear **38**.

The fan-shaped gear **36** is positioned in a first end **8**A in the depth direction F of the cover door body **8**, as shown in FIGS. **11** and **12**. The fan-shaped gear **36** is fixed on a lower side in the vertical direction U of the cover door body **8**.

The pinion gear **37** is rotatably supported on the side wall panel **33** so as to engage with the fan-shaped gear **36**, as shown in FIG. **12**.

The rack gear **38** is disposed on the side wall panel **33** so as to engage with the pinion gear **37** and to be movable in the width direction H, as shown in FIGS. **12** and **14**. The rack gear **38** is positioned above the driving receiver hole **35** of each of the guide grooves **30**M, **30**C, **30**Y and **30**B, as shown in FIGS. **12** and **13**. The rack gear **38** extends in the width direction H.

In the gear transmission structure **31** thus configured, the fan-shaped gear **36** and the pinion gear **37** rotate along with opening and closing of the cover door body **8**, thereby moving the rack gear **38** in the width direction H.

The driving coupling joint **32** is provided with a cylindrical gear body **51**, a cylindrical rotator **52**, a coil spring **53** (biasing member) and a holder case body **54**, as shown in FIGS. **15** and **16**.

On a first end **51**A of the cylindrical gear body **51**, a gear **55** is formed on an outer periphery thereof, as shown in FIGS. **15** and **16**. In addition, on a second end **51**B of the cylindrical gear body **51**, two restriction grooves **56**, **57** and two cam faces **58**, **59** are formed, as shown in FIGS. **15** and **16**. The restriction grooves **56**, **57** are disposed at an interval of 180 degrees along a circumference of the cylindrical gear body **51**, as shown in FIG. **16**. The restriction grooves **56**, **57** open toward the second end **51**B and extend to the vicinity of the gear **55**. The cam faces **58**, **59** are disposed at an interval of 180 degrees along a circumference of the cylindrical gear body **51**, as shown in FIGS. **15** and **16**. The cam face **58** inclines from the second end **51**B of the cylindrical gear body **51** to the gear **55** on the outer periphery, and reaches the restriction groove **56**. In addition, the cam face **59** inclines from the second end **51**B of the cylindrical gear body **51** to the gear **55** on the outer periphery, and reaches the restriction groove **57**, as shown in FIG. **16**.

The cylindrical rotator **52** is provided with a connected hole body **60** and a plurality of cam projections **64**, **65**, as shown in FIG. **15**.

The cylindrical rotator **52** is provided with a connected hole body **60** and a plurality of cam projections **64**, **65**, as shown in FIG. **15**. The connected hole body **60** opens in a first end **52**A of the rotator **52** and extends to a second end **52**B, as shown in FIG. **15**. The connected hole body **60** is composed of a round hole **61** and two fan-shaped holes **62**, **63**. The round hole **61** is formed along an axial center of the rotator **52**. The two fan-shaped holes **62**, **63** are formed at an interval of 180 degrees along a circumference of the round hole **61**. The fan-shaped holes **62**, **63** are communicatively connected to the round hole **61** and have shapes that broaden as approaching an outer periphery of the rotator **52**, as shown in FIG. **15**. The fan-shaped hole **62** is positioned upward in the vertical direction u, as shown in FIG. **15**. The fan-shaped hole **63** is positioned downward. A width of the fan-shaped hole **62** is larger than a width of the fan-shaped hole **63** (fan-shaped hole **62**>fan-shaped hole **63**). The compliant fan-shaped connecting parts **28**, **29** shown in FIG. **2** are inserted into the fan-shaped holes **62**, **63** respectively.

The two cam projections **64**, **65** are disposed on the second end **52**B of the rotator **52**, as shown in FIGS. **15** and **16**. The two cam projections **64**, **65** project in a circumferential direction of the rotator **52**. The two cam projections **64**, **65** are

arranged to correspond to the fan-shaped holes **62**, **63**, respectively, as shown in FIG. **15**. In addition, in the vicinity of the cam projection **65**, a detection projection **66** that projects from the second end **52**B in an axial direction is disposed. The cam projections **64**, **65** have mound shapes on a side facing the cylindrical gear body **51**, when viewed from a projecting direction.

The coil spring **53** is disposed between the second end **52**B of the rotator **52** and a holder case body **54**, as shown in FIGS. **15** and **16**.

The driving coupling joint **32** thus configured is disposed on a reverse side of the side wall panel **33**, as shown in FIGS. **11** to **14**. The driving coupling joint **32** is loaded in a state of facing the driving receiver hole **35** of each of the guide grooves **30**M, **30**C, **30**Y and **30**B.

In addition, as shown in FIGS. **11** to **14**, in a state in which the cover door body **8** is opened, the cylindrical gear body **51**, the rotator **52**, the coil spring **53** and the holder case body **54** of the driving coupling joint **32** are loaded as follows.

The cylindrical gear body **51** is positioned to face the driving receiver hole **35** of each of the guide grooves **30**M, **30**C, **30**Y and **30**B from the reverse side of the side wall panel **33**, as shown in FIGS. **11** and **13**.

The first end **51**A of the cylindrical gear body **51** contacts the side wall panel **33**. The gear **55** engages with the rack gear **38**, as shown in FIGS. **11** and **13**.

The rotator **52** is inserted into the cylindrical gear body **51** from the first end **52**A, as shown in FIGS. **11** and **13**. The cam projections **64**, **65** contact the second end **51**B of the cylindrical gear body **51**, as shown in FIGS. **15** and **16**.

The coil spring **53** is disposed inside the second end **52**B of the rotator **52** and inside the holder case body **54**, as shown in FIGS. **15** and **16**.

Inside the holder case body **54**, the cylindrical gear body **51**, the rotator **52**, and the coil spring **53** are disposed in this order from the second end **51**A side, as shown in FIGS. **14** to **16**. The holder case body **54** is attached to the side wall panel **33**.

As a result, the driving coupling joint **32** is in an initial state in which the rotator **52** is disposed inside the cylindrical gear body **51** with the cover door body **8** being opened, as shown in FIGS. **11** to **14**. Here, the cam projection **65** contacts a restriction wall **67** formed on the holder case body **54**, as shown in FIG. **14**. In addition, the cam projections **64**, **65** of the rotator **52** contact the cam faces **58**, **59** respectively, in the vicinities of ends thereof, near the second end **51**B of the cylindrical gear body **51**. The rotator **52** is thus positioned in a state of being biased by a biasing force of the coil spring **53** toward the driving receiver hole **35** and the restriction wall **67**.

The fan-shaped holes **62**, **63** of the rotator **52** face the driving receiver hole **35**, as shown in FIG. **13**.

When the open/close driving unit Y is closing the cover door body **8** from the opened state as shown in FIGS. **11** to **14**, the rack gear **38** moves to the right as shown in FIG. **18** in a state in which the cover door body **8** is half closed as shown in FIGS. **17** and **18**.

As a result, the cylindrical gear body **51** that engages with the rack gear **38** is in a state of being rotated in a clockwise direction, as shown in FIG. **18**. The cam projections **64**, **65** of the rotator **52** slide on the cam faces **58**, **59** of the cylindrical gear body **51**, as shown in FIG. **20**.

And then, the rotator **52** is moved by the biasing force of the coil spring **53**, inward from the driving receiver hole **35** along a positioning wall **67** as shown in FIG. **19**, and the cam projections **64**, **65** reach and engage with the restriction grooves **56**, **57**. In addition, the fan-shaped holes **62**, **63** engage with the fan-shaped connecting parts **28**, **29** of the open/close coupling joint **24** of the toner supply devices **7**M, **7**C, **7**Y and **7**B.

As shown in FIGS. **21** and **22**, when the installation space G is switched to the closed state by the cover door body **8**, the rotator **52** rotates as the cam projections **64**, **65** engage with the restriction grooves **56**, **57**, thereby rotating the open/close member **22** of each of the toner supply devices **7**M, **7**C, **7**Y and **7**B via the open/close coupling joint **24**. In addition, as shown in FIGS. **6** to **9**, the toner ejection opening **27** faces the toner supply opening **23**.

On the contrary, when the cover door body **8** is being switched from the closed state shown in FIGS. **21** and **22** to the opened state shown in FIGS. **11** and **12**, from the closed state to a half-open state, the rotator **52** rotates as the restriction grooves **56**, **57** of the cylindrical gear body **51** engage with the cam projections **64**, **65** of the rotator **52**, thereby rotating the open/close member **22** of each of the toner supply devices **7**M, **7**C, **7**Y and **7**B via the open/close coupling joint **24**. In addition, as shown in FIGS. **2** to **5**, the toner ejection opening **27** does not face the toner supply opening **23**. Furthermore, from the half-open state to the opened state of the cover door body **8**, rotation of the rotator **52** is restricted as the cam projection **65** thereof contacts the restriction wall of the holder case body **54**. Since the cam projections **64**, **65** have mound shapes on a side facing the restriction grooves **56**, **57**, as the cylindrical gear body **51** rotates, the cam projections **64**, **65** move in an axial direction against a biasing force of the coil spring **53** and reach the cam faces **58**, **59** respectively. And then, the cam projections **64**, **65** slide on the cam faces **58**, **59** and move along the restriction wall **67** in a direction away from the driving receiver hole **35**. Accordingly, the fan-shaped connecting parts **28**, **29** of the open/close coupling joint **24** of the toner supply devices **7**M, **7**C, **7**Y and **7**B are disengaged from the fan-shaped holes **62**, **63**. Thereafter, the rotator **52** of each open/close driving unit Y returns to the initial state shown in FIG. **13**, in which the rotator is inserted into the cylindrical gear body **51**.

Specific Structure of Detection Unit and Notification Unit

Next, a specific structure of a detection unit **71** and a notification unit **81** is described with reference to FIGS. **25** to **28**.

FIG. **25** is a rear perspective view showing a constitution of a detection unit, with a detection subject shielding detection light. FIG. **26** is a rear perspective view showing a constitution of the detection unit, with a detection subject not shielding the detection light. FIG. **27** is a schematic view showing a relationship between the detection unit, a control device and a notification unit, with the detection subject of the detection unit shielding the detection light. FIG. **28** is a schematic view showing a relationship between the detection unit, the control device and the notification unit, with the detection subject of the detection unit not shielding the detection light.

The detection unit **71** detects compatibility of the toner supply devices **7**M, **7**C, **7**Y, **7**B and **107** loaded into the installation space G. The detection unit **71** also detects improper loading (not fully inserted to a loading position) of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B.

The notification unit **81** notifies loading of the noncompliant toner supply device **107** or improper loading of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B to the inside of the installation space G.

The detection unit **71** is disposed on a reverse side of the side wall panel **33**, as shown in FIGS. **25** and **26**. The detection unit **71** is provided with a detection moving member **72**, a detector **73**, a detection object member **74**, a spring member **75** (biasing member), as shown in FIGS. **25** to **28**.

The detection moving member **72** is movably provided to extend in the width direction H of the apparatus main body **1** as shown in FIGS. **25** to **28**. The detection moving member **72** has a plurality of moving projections **72**A, as shown in FIGS. **27** and **28**. The detection projection **66** of each open/close driving unit Y contacts each moving projection **72**A.

The detector **73** is composed of a light emitting part **76** that emits detection light and a light receiving part **77** that receives the detection light, as shown in FIGS. **25** to **28**. The detector **73** is connected to a control device **78** in the apparatus main body **1**.

The detection object member **74** is disposed between the light emitting part **76** and the light receiving part **77** of the detector **73**, in a state in which the cover door body **8** is opened, as shown in FIGS. **11** and **12**. The detection object member **74** shields the detection light emitted from the light emitting part **76** of the detector **73**.

The spring member **75** biases the detection object member **74** toward the detector **73** by a biasing force, as shown in FIGS. **27** and **28**.

The notification unit **81** is connected to the control device **78**, as shown in FIGS. **27** and **28**. The notification unit **81** is composed of a display, a speaker and the like. The notification unit **81** is disposed in the apparatus main body **1** shown in FIG. **1**. The notification unit **81** makes notification by display and sound.

The control device **78** determines the toner supply devices **7**M, **7**C, **7**Y, **7**B and **107** loaded into the installation space G or improper loading of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B, based on a result of detection (ON/OFF of the detection light) by the detection unit **71**, as shown in FIGS. **27** and **28**. Furthermore, the control device **78** outputs a notification instruction to the notification unit **81**, based on a result of determination.

Loading Procedure of Toner Supply Device

An application procedure of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B and an application procedure of the noncompliant toner supply device **107** are described hereinafter with reference to FIGS. **1** to **29**.

FIG. **29** is a perspective view showing a state in which the toner supply device is loaded into the installation space. For the sake of illustration, the cover door body **8** is in the opened state as shown in FIGS. **11** and **12**, thereby exposing the opening of the installation space G. Accordingly, the open/close driving unit Y is in the initial state, as shown in FIGS. **13** and **14**.

In addition, the cam projection **64** of the rotator **52** contacts the second end **51**A of the cylindrical gear body **51** as shown in FIG. **26**, and pushes the detection moving member **72** toward the detection object member **74** as shown in FIG. **28**. The detection moving member **72** thus moves the detection object member **74** away from the detector **73**, against the biasing force of the spring member **75**.

1. Loading Procedure of Compliant Toner Supply Devices **7**M, **7**C, **7**Y, **7**B

An engineer loads the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B of magenta, cyan, yellow and black into the installation space G.

Upon loading the toner supply devices **7**M, **7**C, **7**Y and **7**B into the installation space G, the compatible open/close coupling joint **24** is inserted respectively into the guide grooves **30**M, **30**C, **30**Y and **30**B shown in FIG. **11**, as shown in FIG. **2**. Subsequently, each of the toner supply devices **7**M, **7**C, **7**Y and **7**B is moved into the installation space G, as shown in FIG. **29**.

Each of the toner supply devices **7**M, **7**C, **7**Y and **7**B is inserted to such a position that the compatible open/close coupling joint **24** faces the rotator **52** of the driving coupling joint **32**, as shown in FIGS. **11** and **13**.

As a result, the fan-shaped connecting parts **28**, **29** of the compatible open/close coupling joint **24** face the fan-shaped holes **62**, **63** of the rotator **52** shown in FIG. **13**.

An engineer loads the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B into the installation space G and closes the cover door body **8**. When the cover door body **8** is closed, the cylindrical gear body **51** of the driving coupling joint **32** is rotated by the fan-shaped gear **36**, the pinion gear **37**, and the rack gear **38** of the gear transmission structure **31**, as shown in FIGS. **11**, **18** and **22**. As the cylindrical gear body **51** rotates, the cam projections **64**, **65** of the rotator **52** slide respectively on the cam faces **58**, **59** of the cylindrical gear body **51**, as shown in FIGS. **14**, **20** and **24**. The rotator **52** is thus rotationally moved toward the driving receiver hole **35**.

Accordingly, the fan-shaped connecting parts **28**, **29** of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B are fitted into the fan-shaped holes **62**, **63** of the rotator **52**, respectively. The compatible open/close coupling joint **24** is connected to the driving coupling joint **32**.

As the compatible open/close coupling joint **24** is connected thereto, the driving coupling joint **32** rotates (moves) the compatible open/close coupling joint **24**. The open/close member **22** is thus also rotated (moved).

As the open/close member **22** rotates, the toner ejection opening **27** is communicatively connected to the toner supply opening **23**, as shown in FIGS. **7** to **9**. And then, by rotationally driving the screw conveyor **25** of each of the toner supply devices **7**M, **7**C, **7**Y and **7**B, the toner of each color is fed from the toner supply opening **23** to each of the image forming units **2**M, **2**C, **2**Y and **2**B shown in FIG. **1** through the toner ejection opening **27**.

The screw conveyor **25** is driven as a driving transmission means (not illustrated), provided on the second end **25**B side, and is engaged with a driving means in the apparatus main body.

In accordance with a closing movement of the cover door body **8**, the cam projections **64**, **65** of the rotator **52** slide respectively on the cam faces **58**, **59**, as shown in FIGS. **14**, **20** and **24**. As a result, the detection projection **66** is moved away from the detection moving member **72**, as shown in FIGS. **25** and **27**.

The detection object member **74** is thus maintained in a state of being biased by the biasing force of the spring member **75**, as shown in FIG. **27**. The detection object member **74** is inserted between the light emitting part **76** and the light receiving part **77** of the detector **73**, thereby shielding the detection light emitted from the light emitting part **76** of the detector **73**.

The control device **78** determines that the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B are loaded into the installation space G in a case in which the detection light of the detector **73** is shielded when the installation space G is in the closed state by the cover door body **8**, as shown in FIG. **27**. In this case, the notification unit **81** does not make notification.

Loading Procedure of Noncompliant Toner Supply Device

An engineer loads the noncompliant toner supply device **107** into the installation space G in a state in which the cover door body **8** is opened, as shown in FIGS. **11** and **12**.

Upon loading the toner supply device **107** into the installation space G, the noncompliant open/close coupling joint **124** is inserted respectively into the guide grooves **30**M, **30**C, **30**Y and **30**B shown in FIG. **11**, as shown in FIG. **10**. Subsequently, the toner supply device **107** is moved into the installation space G, as shown in FIG. **29**.

The toner supply device **107** is inserted to such a position that the noncompliant open/close coupling joint **124** faces the rotator **52** of the open/close driving unit Y, as shown in FIGS. **11** and **13**.

As a result, the fan-shaped connecting parts **128**, **129** of the noncompliant open/close coupling joint **124** face the fan-shaped holes **62**, **63** of the rotator **52** shown in FIG. **13**.

When the engineer has loaded the noncompliant toner supply device **107** to the installation space G and closed the cover door body **8**, the cylindrical gear body **51** of the driving coupling joint **32** is rotated by the gears **36**, **37**, **38** of the gear transmission structure **31**, as shown in FIGS. **11**, **18** and **22**.

Here, the fan-shaped holes **62**, **63** of the rotator **52** and the noncompliant fan-shaped connection parts **128**, **129** have mismatched shapes. Accordingly, the fan-shaped connection parts **128**, **129** cannot be inserted into the fan-shaped holes **62**, **63**.

The driving coupling joint **32** and the noncompliant open/close coupling joint **124** are thus in a non-connected state (not connected to each other), thereby restricting movement of the rotator **52** toward the driving receiver hole **35**. Unless the rotator **52** moves toward the driving receiver hole **35**, the detection projection **66** is maintained to project toward the detection moving member **72**. The detection projection **66** rotates in contact with the moving projection **72**A of the detection moving member **72**, thereby moving the detection moving member **72** against the biasing force of the spring member **75**, as shown in FIGS. **26**. The detection object member **74** is thus rotationally ejected from the detector **73**, without shielding the detection light emitted from the light emitting part **76** of the detector **73**, as shown in FIGS. **26** and **28**.

Unless the rotator **52** rotates, the cam projections **64**, **65** are maintained to contact the second end **51**B of the cylindrical gear body **51**.

The cam projections **64**, **65** contact the moving projections **72**A of the detection moving member **72**, as shown in FIG. **26**. The detection object member **74** thus does not shield the detection light emitted from the light emitting part **76** of the detector **73**, as shown in FIGS. **26** and **28**.

The control device **78** determines that the noncompliant toner supply device **107** is loaded into the installation space G in a case in which the detection light of the detector **73** is not shielded when the installation space G is in the closed state by the cover door body **8**, as shown in FIG. **28**.

As a result, the control device **78** outputs the notification instruction to the notification unit **81**, as shown in FIG. **28**. In response to the notification instruction thus inputted, the notification unit **81** notifies loading of the noncompliant toner supply device **107** on the display and by sound.

The engineer opens the cover door body **8**, removes the noncompliant toner supply device **107** from the installation space G, and loads the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B into the installation space G.

Improper Loading of Compliant Toner Supply Device

Upon loading the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B into the installation space G, the driving coupling joint **32** and the compatible open/close coupling joint **24** are in the non-connected state if the open/close coupling joint **24** is not fully inserted into the guide grooves **30**M, **30**C, **30**Y and **30**B.

In such a state, the movement of the rotator **52** of the driving coupling joint **32** toward the driving receiver hole **35** is restricted as in a case of loading of the noncompliant toner supply device **107**. The detection projection **66** thus rotates in contact with the moving projection **72**A of the detection moving member **72**, as shown in FIGS. **26** and **28**.

The detection object member **74** thus does not shield the detection light of the detector **73**, as shown in FIGS. **26** and **28**.

The control device **78** determines that the toner supply devices **7**M, **7**C, **7**Y and **7**B are improperly loaded into the installation space G in a case in which the detection light of the detector **73** is not shielded when the installation space G is in the closed state by the cover door body **8**, as shown in FIG. **28**.

As a result, the control device **78** outputs the notification instruction to the notification unit **81**, as shown in FIG. **28**. In response to the notification instruction thus inputted, the notification unit **81** notifies the improper loading of the toner supply devices **7**M, **7**C, **7**Y and **7**B on the display and by sound.

The engineer opens the cover door body **8**, removes the toner supply devices **7**M, **7**C, **7**Y and **7**B improperly loaded from the installation space G, and reloads the toner supply devices **7**M, **7**C, **7**Y and **7**B into the installation space G.

As an application of the detection of improper loading, a so-called noncompliant configuration, which does not allow full insertion unless shapes conform to each other, can be employed by making shapes partially different between the cartridge container **21** and the installation space G in the vicinity of an end thereof, where the open/close coupling joint **24** of the toner supply devices **7**M, **7**C, **7**Y and **7**B is provided. Such a configuration allows detection and discrimination of toner supply devices of a greater variation, by combination of the shapes of the open/close coupling joint **24** and the shapes of the cartridge container **21**. As an example of the noncompliant configuration, a configuration can be employed in which the cover door body **8** cannot be completely closed in a case in which a noncompliant toner supply device is loaded. However, since the cover door body **8** is a relatively large member, false detection is likely due to variation of size in production and deformation by deflection. In addition, there is a possibility of breakage due to forced closing of the cover door body **8**. The configuration of detecting incompatibility by detecting improper loading of the present invention can provide a reliable detection with only a small change in shape, without a risk of breakage of the apparatus and the like.

As described above, the image forming apparatus X of the present invention detects types of the toner supply devices **7**M, **7**C, **7**Y, **7**B and **107** (compatible or noncompliant) by detecting a rotated position of the rotator **52** of the driving coupling joint **32** by the detection unit **71**.

In addition, as the rotator **52** is rotated, the toner supply opening **23** of the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B is switched to the opened state. On the other hand, if the rotator **52** is not rotated, the toner supply opening **23** of the noncompliant toner supply device **107** or the compliant toner supply devices **7**M, **7**C, **7**Y and **7**B being improperly loaded is in the closed state. The detection unit **71** can thus detect open and close of the toner supply opening **23** of the toner supply devices **7**M, **7**C, **7**Y and **7**B.

The notification unit **81** can make notification based on the rotated position of the rotator **52** and open and close of the toner supply opening **23**.

This can prevent use of the apparatus main body with the noncompliant toner supply device loaded thereinto. In addition, since the apparatus main body does not operate with the toner supply device improperly loaded, leakage of toner and a toner supply defect can be prevented.

In the image forming apparatus X of the present invention, a configuration of detecting a type of each toner supply device loaded into the installation space G or detecting improper loading of a toner supply device can be realized without

providing the detection unit **71** to each of the guide grooves **30**M, **30**C, **30**Y and **30**B. As a result, even an apparatus with a plurality of image forming units will not have a complex structure, and can be reduced in size and cost.

INDUSTRIAL APPLICABILITY

The present invention can be preferably applied to image forming apparatuses using xerography such as a copy machine, a printer, a facsimile machine and the like, and other printing machines, that form (transfer) an image on printing paper using a toner.

What is claimed is:

1. An image forming apparatus comprising:

at least one image forming unit that is disposed in an apparatus main body and forms a toner image;

at least one toner supply device that is loadable and unloadable with respect to an installation space in the apparatus main body and supplies a toner to the image forming unit, in which the toner supply device includes a toner supply opening that is communicatively connected to the image forming unit and an open/close member that opens and closes the toner supply opening;

a detection unit that detects, regarding the toner supply device loaded into the installation space, a type of the toner supply device or detects improper loading of the toner supply device; and

a notification unit that notifies loading of the toner supply device of a wrong type or improper loading of the toner supply device based on a result of detection by the detection unit,

wherein the toner supply device comprises an open/close joint that operates the open/close member to open and close;

the open/close joint has different shapes according to the type of the toner supply device;

the apparatus main body comprises a driving joint that has a shape that can or cannot be connected to the open/close joint according to a shape of the open/close joint after loading the toner supply device to the installation space, the driving joint switching the open/close member of the toner supply device to an opened state by driving the open/close joint when connected; and

the detection unit detects the type of the toner supply device based on an opened or closed state of the toner supply opening of the toner supply device.

2. The image forming apparatus according to claim **1**, wherein the driving joint is not connected to the open/close joint in a case in which the toner supply device of a correct type is improperly loaded into the installation space, and

the detection unit detects improper loading of the toner supply device based on a closed state of the toner supply opening.

3. The image forming apparatus according to claim **1**,

wherein the driving joint comprises a rotator that has a shape that can or cannot be connected to the open/close joint according to the shape of the open/close joint after loading the toner supply device to the installation space, the rotator rotating upon connection with the open/close joint, and

the detection unit detects the type of the toner supply device based on a position of the rotator.

4. The image forming apparatus according to claim **3**, wherein the rotator is not connected to the open/close joint in a case in which the toner supply device of a correct type is improperly loaded into the installation space, and

the detection unit detects improper loading of the toner supply device based on a position of the rotator.

5. The image forming apparatus according to claim **1**, wherein the apparatus main body comprises a cover door body that opens and closes an opening of the installation space,

the cover door body opening and closing the opening of the installation space in a state in which the toner supply device is loaded into the installation space.

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